

POPULAR SCIENCE

MONTHLY

JUNE

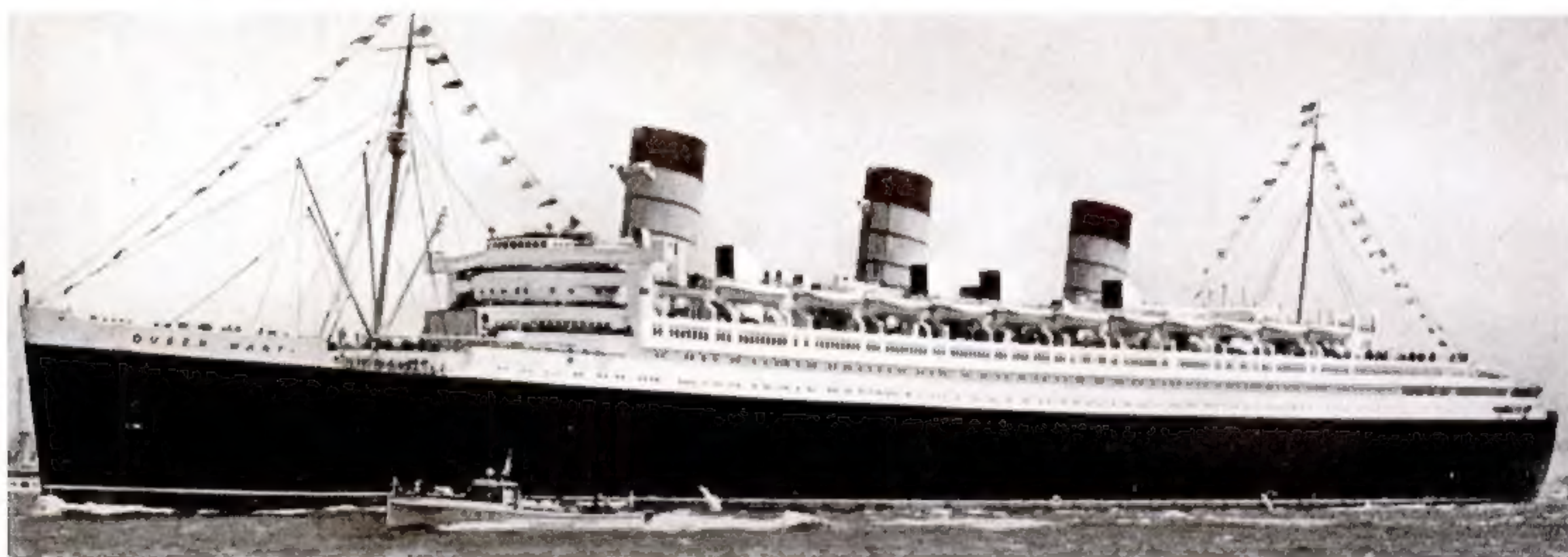
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Launches Giant Planes**
PAGE 55

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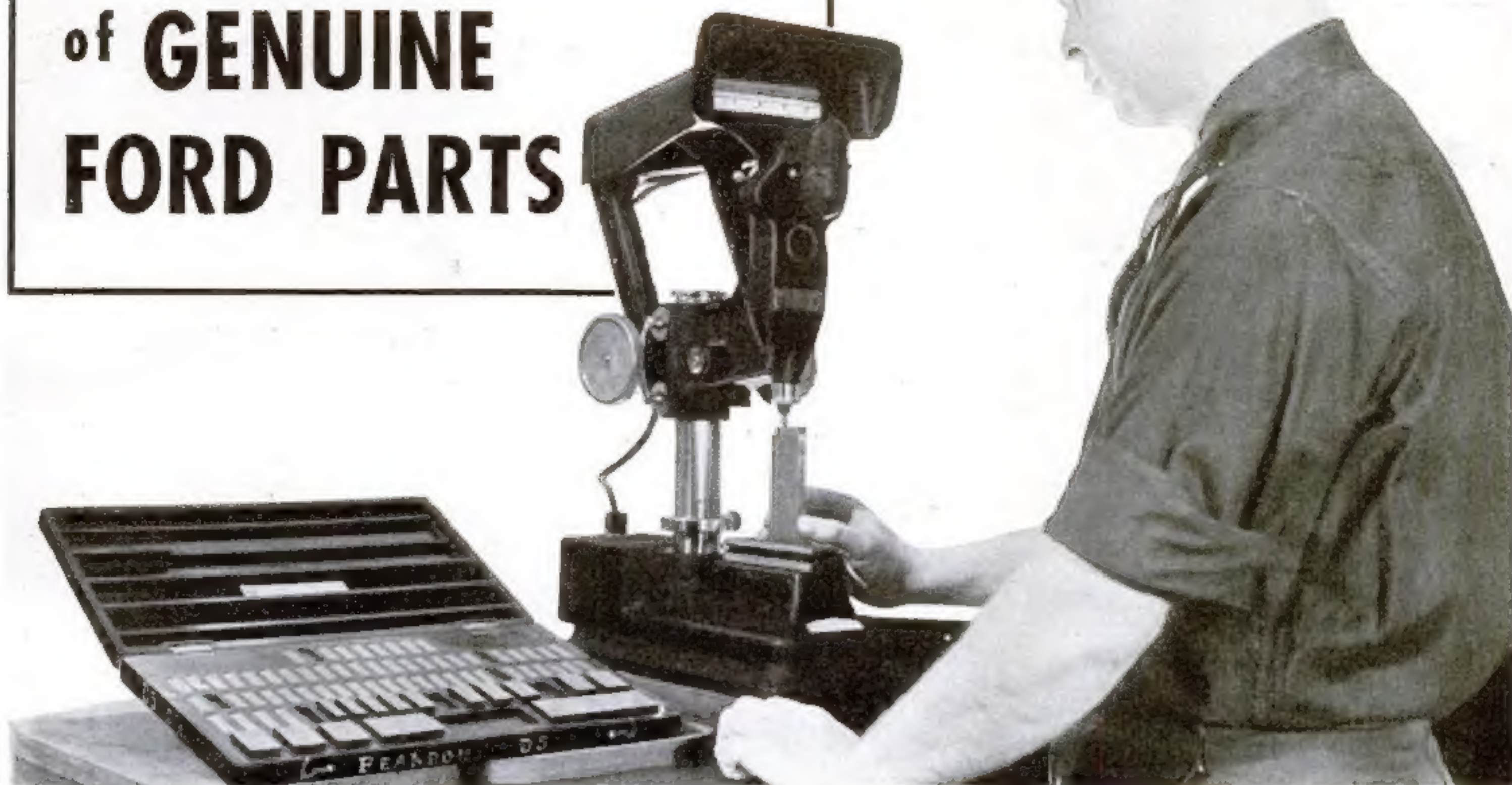


This One



42HC-DFZ-3CJZ

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Even texture, correct hardness, uniform resistance and long life are features of Genuine Ford Generator Brushes. Per set of three, 18c.

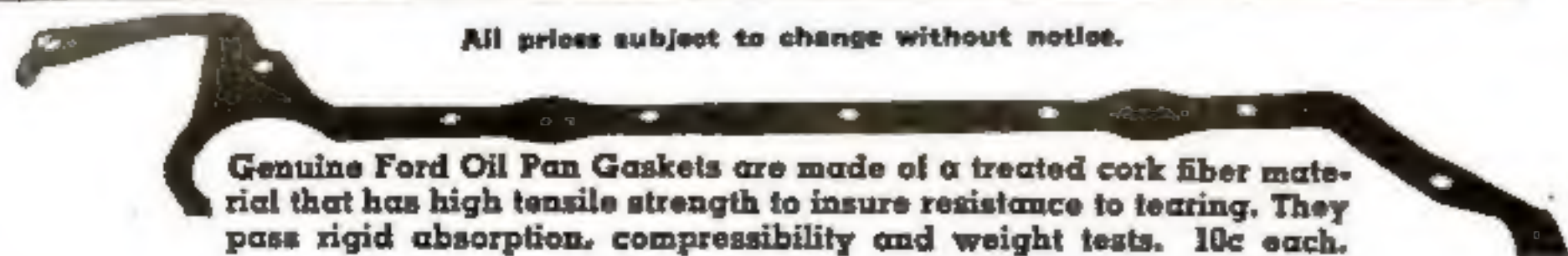
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Dearborn Michigan

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Our Readers Say



He'd Turn Chemistry Fans Into Detectives

HERE is a suggestion in answer to your recent invitation asking readers to express their ideas on the kind of chemistry experiments they like best. How about the process used in making stainless fingerprint impressions? You could tell us how to make the solutions for treating the paper and the impression pad. Another fingerprint process that could be the subject of interesting experiments is that used in the savings division of the Post Office Department.—C. T., Bronx, N. Y.

WHEN I LEARN FINGERPRINTING I'LL BE A "DICK"!



Too Good a Photographer To Take Any Pictures

WITH all due respect for your excellent articles on photography, I haven't much of an opinion of these fellows who take their picture-taking so seriously. Last summer, I went on a trip with one of them, and it disillusioned me completely. Having an expert photographer with me, I naturally thought I would get some wonderful pictures as souvenirs of the trip. From the very start, however, he began giving alibis. To begin with, his very best camera was lent to a friend, so he had to be contented with his second-string outfit, which didn't have quite all the special lenses and gadgets on it. He refused to take any shots where the lighting conditions were ideal; that was elementary stuff, and he couldn't be bothered with it. But when there was a difficult shot to make, he'd just say, "Gee, if I only had my good camera here!" The result was that he didn't get any pictures. Fortunately, I had my little old two-dollar box camera with me, and snapped away at everything I saw. Some of the pictures turned out fine, and I had the pleasure of sending prints to my high-hat companion.—D.M., Boston, Mass.

But the Dictionary Says A Ball Is a Bearing, Too

OLD BILL, in a recent issue of your admirable magazine said, "A ball bearing of the proper size, if pushed through an undersize hole, will burnish and size the hole." Now old Bill must know that a steel ball is the thing to push through a hole, not a ball bearing, which is an assembly of balls, retainer, and cones. Won't someone start a crusade against this inexcusable, but nevertheless almost universal mistake? To say "bearing ball" would be better, even though the balls are used for other purposes. I am sure Old Bill will accept this little "amendment."—C.E.P., Jr., Bridgeport, Conn.

GUESS YOU AIN'T A BALL BEARING AFTER ALL



Another University Uses Voice Recordings

VISUALIZING the extent of Northwestern University's sound-recording facilities from the photograph you published in a recent issue, I would like to point out that the system used here at Columbia University is a great deal more developed. The language departments have modern, soundproof recording studios, built especially for the purpose, and fitted with the latest innovations. In the French department the equipment is employed as part of the final examination in the oral courses. The recordings are made on metal disks, at the beginning, middle, and end of the course, so that at the end of the semester, each student has a complete record of his speech development. Also, in the English department, the recordings are made of each freshman's voice, as an integral part of his curriculum.—C.D.I., Jr., New York City.

Found: A Pleasant Reason For Visiting the Dentist

HERE is an idea which I would like to pass along to other model makers. Very small drills are often required for building ship models like the ones described in P.S.M., and commercial drills run into money, especially when you consider that they usually call for special chucks or holders. I got into conversation with my dentist, and he suggested that I try using some of his discarded drills. Although they are rather slow, and will cut to only a limited depth, I find that they serve the purpose very well. In one way they are better than ordinary drills, because they do not tend to crack or split small pieces. These drills come in all sizes from one thirty-second inch to one eighth inch, and any dentist will be glad to give you the ones he is ready to discard. I used these drills to make small holes in the many blocks and other tiny parts of the *Swallow*, which I built from your plans. Anyone who has ever tried it knows how difficult it is to make a number of these parts without spoiling a lot of twist drills.—H.G., Jr., Media, Pa.

YEAH, BUT YOU OUGHTA SEE THE DRILLS I GOT!



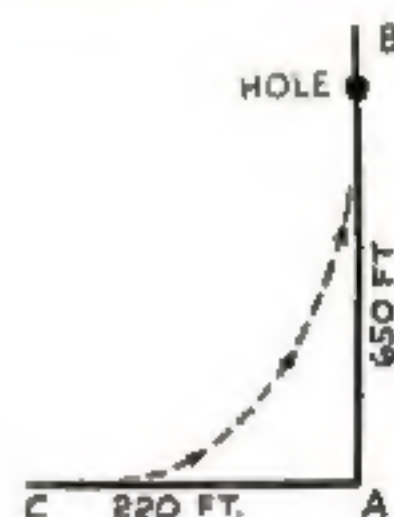
Even the Mississippi River Runs Uphill, He Says

"WE've all known for years that water won't run uphill," says G.A.O., of Dover, N. J., in razzing the reader who was fooled by the Mount Freedom, N. J., road illusion. Probably he doesn't know that he is being fooled by an illusion, too. According to accepted theories, a point on the earth's equator is thirteen miles farther from the center of the earth than either the north or south pole. Hence the outlet of the Mississippi River is about four and a half miles farther from the center of the earth than its source. This certainly is a case of water running uphill. Prob-

ably G.A.O. can tell us whether or not he wants us to call this an optical illusion, also.—W.B., Chicago, Ill.

Regardless of Figures, We're for the Rabbit

I SECOND the motion of F.L.M., Aurora, Ill., for a problem in every issue, and, to help the thing along, offer one concerning the fate of a rabbit. This bunny runs at fifteen miles an hour along a straight line AB toward his hole, which is 650 feet away from A. When he is at A, a hound starts from C, 220 feet away in a line perpendicular to AB, chasing him at eighteen miles an hour, following the curve shown in the drawing. Does the rabbit beat the hound to the hole, or does he get caught?—S.A.M., Sykesville, Md.



More Organic Chemistry, This Reader "Wailes"

LET me add my voice to the requests for more articles on organic chemistry. The last one was long ago, Mr. Wailes, too long ago! Organic chemicals are all around us; we eat them, work with them, and cure our ills with them. Vinegar, starch, sugar, gelatin, and many other foods are organic chemicals. In the average household can be found oxalic acid, carbon tetrachloride, cream of tartar, glycerin, alcohol, aspirin, and many other products. With such a start, and with some of the inorganic chemicals we have accumulated from past experiments, most of us are all ready for some good organic experiments. Now that I have chemistry off my chest, let me compliment you on your fine magazine. Among other things, it is remarkable for giving advance information on commercial products. One reads of a new invention in P.S.M., and two or three months afterward it is sold in one's neighborhood stores.—E.D., Bronx, N. Y.

A Dissenting Opinion on Gasoline Mileage

IN YOUR April issue, W.T.M. says that maximum gasoline mileage is obtained from an automobile when the vacuum in the intake manifold is not decreased to the point where it materially affects the speed of the wiper. Not so. Maximum motor efficiency is obtained with the highest pressure in the manifold, or when the wiper almost stops. If your gasoline is almost gone, open the throttle wide, then coast and (Continued on page 5)

NO MILEAGE WHEN YOU NEED A LIFT!



OUR READERS SAY

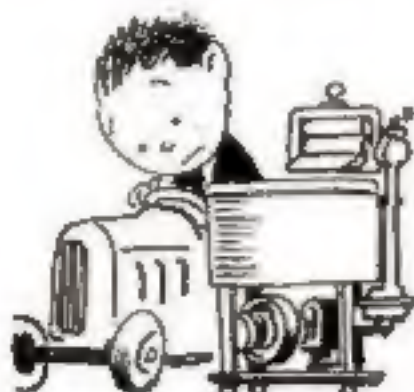
(Continued from page 4)

shut off the ignition. Repeat this, accelerating and coasting until you reach a filling station, but don't expect your wiper to be of any use. —D.K.W., Sarasota, Fla.

The Family Washing Machine Loses Another Part

ONE of these days, I would like to open P.S.M. and see plans for a midget automobile. I mean the kind that uses a half or three-quarter-horse-power motor of the washing-machine type. The article should include complete plans, along with a list of the materials needed. The type of auto I have in mind is on the style of a dirt-track racer, with the motor mounted behind the seat. —W.H., Goshen, Ind.

NOW, IF I JUST HAD A MOTOR!



Schoolboys Would Outsmart The Mechanical Teacher

ALTHOUGH my school days are a thing of the distant past, I do seem to remember that, as pupils, most of us were inclined to be rather ingenious in getting by with as little work as possible. I don't think boys have changed much in that respect, and am afraid that the "mechanical teacher" reported in your May issue is going to be easy pickings for the pupils on whom it is used. The machine is described as recording black pencil marks made by the pupils in "yes" or "no" spaces after each question on the examination. All the incorrect answers are masked off, and only the ones that are correct will affect the machine. All very good, but what would prevent an ingenious youngster from blackening all the spaces; answering both "yes" and "no" to each question? The "mechanical teacher" would then give him a perfect score! —F.M.C., Detroit, Mich.

He Wants To Delve into The World of Minerals

I HAVE read a lot about chemistry and microscopy in P.S.M., but have never seen anything relating to another interesting science, mineralogy. Many of us are anxious to know more about the different types of stone we encounter in our neighborhoods, and I would like to suggest that you print an article telling readers how to start a collection of rare minerals and stones, and how to recognize and classify the different specimens. —G.L.B., Dallas, Tex.

HM PRETTY! BUT WHAT IS IT?



"Windburn" Is No Myth, Her Experience Proves

THE experiments described in your recent article, "Tests Show Windburn To Be Only a Myth," seem to me to be inconclusive, because the temperature of the wind was not taken into consideration. A few years ago, we took our three-month-old daughter on a motor trip, and since we took precautions to shield her from the direct sun, had little trouble, until we ran into a temperature of 106 degrees and a strong breeze. Although we watched constantly to see that the sun's rays did not strike her, (Continued on page 6)

Re-Vitalize YOUR ENGINE



WITH NEW

CHAMPION

SPARK PLUGS

Spark Plug Change Week is Champion's annual reminder to millions of motorists that Spring is engine tune-up time. Champion dealers everywhere are at your service to show you why all spark plugs, including even Champions, should be retired from active service after 10,000 miles. The habit of changing spark plugs during Change Week has grown enormously simply because new Champion Spark Plugs have proved in service that they re-vitalize engine performance and actually save their cost in renewed gasoline economy. See your Champion Spark Plug dealer this week. Have him check and clean your spark plugs, and replace with new Champions, if necessary. You can depend on Champion Spark Plugs.

SPARK PLUG
CHANGE WEEK
MAY 3-9

CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL



I MADE THE BIGGEST MISTAKE A MAN IN LOVE COULD MAKE!

YOUR MISTAKE CAN'T BE AS SERIOUS
AS YOU LOOK. WHAT'S WRONG?

SIMPLY THIS—I STOPPED
USING LIFEBOUY AND
BEFORE I KNEW IT I
LOST MY GIRL



I THOUGHT YOU WERE SMARTER
THAN THAT! DON'T YOU KNOW
LIFEBOUY CONTAINS A
SPECIAL PURIFYING
INGREDIENT NOT IN THE
OTHER WELL-KNOWN
SOAPS?

NOW I DO—
BUT HOW'S
MARIE TO
KNOW I
KNOW



I'LL HAVE A PARTY
AND INVITE YOU
BOTH. THEN IT'S
UP TO YOU

YOU'RE A
REAL PAL!



"B.O." GONE—Marie returns

I HAVEN'T HAD
SO MUCH FUN
IN AGES! YOU'RE
GRAND COMPANY!

HE THINKS
AND I'M ALWAYS GOING
TO BE "GRAND COMPANY"
BECAUSE I'LL
NEVER BE GUILTY
OF "B.O."
AGAIN!



Spring beauty tip

WISE WOMEN entrust their precious skin to soap that is *thorough* and *mild*...Lifebuoy! Its purifying lather penetrates the pores, removes beauty-marring dirt and waste...and protects the skin's alluring smoothness. It's 20% milder *by test* than many so-called "beauty" and "baby soaps."

Trust Lifebuoy to keep you immaculate,

too! It's used by more American women for the bath than any other soap—And by more men and children, too. These facts were revealed when 8 leading magazines questioned 120,000 women. Its purifying lather stops "B.O."



Approved by
Good Housekeeping Bureau

TRY THIS Milder LATHER FOR SOOTHING SHAVES

THIS SHAVING BUSINESS
IS A HEADACHE. WITH MY
HEAVY, BLACK BEARD I
SHOULD SHAVE CLOSE.
BUT IF I DO, MY FACE
GETS ALL RED AND SORE



TRY LIFEBOUY SHAVING
CREAM. I'LL BET A NEW
HAT IT'LL GIVE YOU CLEAN,
CLOSE SHAVES IN SOLID
COMFORT. ITS LATHER HOLDS
52% MORE MOISTURE THAN
ORDINARY LATHERS—
WILTS THE STIFFEST
WHISKERS



JIM WINS A HAT! I'VE
JUST HAD THE CLEANEST,
SMOOTHEST SHAVE
EVER. LIFEBOUY IS
MILD, TOO. SO EASY
ON THE SKIN

Send for a FREE Trial Tube

Try it—see for yourself. Get the big red tube at your druggist's. Or write Lever Brothers Co., Dept. A-146, Cambridge, Mass., for a free 12-day tube. This offer good in U. S. and Canada only.



Lots
milder than other
leading shaving soaps.

OUR READERS SAY

(Continued from page 5)

and covered the windows of the car with cloth, she burned so badly that her face, arms, and legs were swollen. It seems to me that this is a true case of windburn, and that scientists ought to make more conclusive tests on this important subject.—Mrs. E.P., Estacada, Ore.

Sock Problem Suggests A Darned Good Idea

Is my face red! Here I've gone and struggled for hours over J.D.'s problem of the socks, only to have R.J.S., Jr. point out the answer that was right before my nose all the time! I got off on a totally wrong track by confusing socks with shoes, and imagining that there were such things as right and left-hand stockings. It brings up an interesting reflection, though. Why aren't socks made to fit right and left feet? It seems to me that the toes could be made to wear much longer if the stocking conformed to the shape of the foot, than under the present system, where they are necessarily stretched out of shape when they are being worn.—B.E.P., New London, Conn.

But What Happens When The Road Blows Out?

THERE are dozens of ways to make use of old automobile tires; they can be used for everything from door mats to drinking fountains for chickens, but, in spite of this, they accumulate faster than they can be disposed of. My suggestion is this: why not use the old tires to reinforce concrete roads? The tires could be laid side by side all over the road bed, and concrete poured over them until it covers the tires by at least two inches. This would probably reduce the cost of road construction, and such a highway would have a good degree of elasticity. It would seem worth while to try out this method on several blocks of streets that are heavily traveled, in order to test the idea.—I.K.G., Biglerville, Pa.



Armchair Sailor Likes Navy Articles

As a steady reader of P.S.M., I would like to see more about the U.S. Navy and its activities. The story "Boys Build Battleships," in a recent issue, was great. Give us more articles like this.—N.S.B., MacLeod, Alberta, Canada.

Here's Another Way To Kill Poison Ivy

WITH the warm weather coming on, I would like to make a suggestion to those readers who recently asked for ways of killing poison ivy. For two years I have used crude carbolic acid, and it never fails. Just dig a small hole around the plant, put in two or three spoonfuls of the acid, and the work is done. Come back in forty-eight hours and look at the plant!—G.W.M., Kansas City, Kans.

Maybe the Astronomy Series Would Be The Place for This

ALTHOUGH from time to time you have published many articles on the motion-picture industry, dealing with cameras, scenery, and sound effects, there is one important phase of the movie (Continued on page 7)

OUR READERS SAY

(Continued from page 6)

industry that you have not yet covered. It is the actors and actresses. Why not publish a few articles concerning them? Among your readers, I am sure there would be many who would like to know something of what it takes to be a star, and I think such an article would be appreciated by these readers.—T.F., Vashon, Wash.

Somebody's Always Bringing This Thing Up Again

IN LOOKING over my back issues, I came across a lot of letters from readers on the question of whether or not snakes swallow their young to protect them. To settle the dispute, I suggest that all the amateur scientists of Our Readers Say arm themselves with cameras, and sally forth this summer to catch a snake in the act. A photograph of the young snakes being swallowed should certainly be interesting, and would solve the problem once and for all.—J.J.P., New Kensington, Pa.



"Anti-Skeptic" Club Would Dispel "Common-Sense" Ideas

IT MIGHT be a good idea for M.T.L. of Brooklyn, N. Y., to form an anti-skeptic club rather than the common-sense club he advocated in his recent letter. For centuries, the "common sense" view that the sun revolved around the earth was universally accepted. Scientists, however, with their "foolish ideas," proved that the exact opposite is true. Likewise, I think that astronomers have quite definitely established the fact that meteorites do come from outer space, and that most of us can accept this statement regardless of the opinions of skeptics who know little about the subject.—D.N.M., Philadelphia, Pa.

The Rowboat Problem Presents An Exercise in Navigation

HERE'S my solution to H.E.H.'s recent problem of the man in the boat. If he takes the following route, which will require that he pack a surveyor's transit with him, he will get to town in the quickest possible time, provided that he doesn't get lost in the rough country: The man should row straight to shore, then turn and run toward the road at an angle of $36^{\circ}52'$ to the shore line, and travel in that direction for 3.75 miles. He will strike the road at a point 2.75 miles from town. The total distance of seven and a half miles, by this route, will be covered by the man in an hour and twenty-four minutes.—H.F.M., Shenandoah, Pa.

NOW WITH A COUPLE OF MAINE GUIDES I MIGHT MAKE IT!



Thinks He's Discovered A Stowaway

I HAVE just discovered an odd illusion, which perhaps can be explained by other Our Readers Say fans. In the February, 1937 issue of P.S.M., look on the bottom of page 62, at the picture of the two-motor monoplane. In the motor nacelle, just above the propeller and over the man at the right, I see a face. Is this ghost photography?—A.B.M., Woonsocket, R. I.

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CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letter within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of the statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless sufficient postage is provided for this purpose. Address your contribution to Success Story Department, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, N. Y.

HELD JOB WHEN OTHER GOOD MEN LOST OUT

After graduation from high school at the age of sixteen, I spent nine years in various occupations in various places. The last of my many jobs was that of an oiler in a hydro electric plant.

My duties in that capacity were just as elementary and onerous as the title would indicate. They consisted in supplying the machines under my care with a proper ration of oil at certain intervals, also the less elegant and more prosaic job of plant janitor and grease wiper.

This work, the previous nine years, and my lack of progress during them, served to eradicate such ideas as I might have had about the sufficiency of my preparation to cope with life. After taking stock, I came to the conclusion that the business of making a living was not the gold-plated cinch that I once thought, and that my educational equipment was sadly in need of some specialized bolstering.

I realized that my limitations closed certain channels to me, and that other factors denied me further residence schooling. This made it imperative that I investigate the possibility of home study under the guidance of some recognized correspondence school.

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Secrets of Success

At this juncture I discussed the matter with my plant superintendent, who was an old ——— School man. As a result of this conversation I enrolled with this school for their course in Electrical Engineering, covering operating. I had no particular difficulty in completing this course in due time as I was able to devote long hours to study. I found the work both entertaining and instructive, for I was working at my study, and studying the things with which I was working. The lessons also furnished something to occupy my spare time, and one sometimes finds this quite a problem, as the social activity at isolated hydro plants is oftentimes somewhat circumscribed.

The hill is long and high, and by no means have I attained the top, but I have passed through the various operating grade to a Division Load Dispatcher at a salary which at one time was two and one-half times the original figure. It is hard to say just what part home study had in this, or to properly evaluate each factor responsible in my case. I feel sure, however, that it must have had a major part. I feel, too, that it was instrumental in my being able to work eleven and one-half years without the loss of a single day's pay.

I consider this quite an achievement because those years embraced the period of highest unemployment in history, a period in which good men close around me were listed as casualties. The ability to hang on, and the fact that I passed through those years with salary relatively unimpaired, I am sure was not accidental. It was due in part to a foundation of home study grounded in industrious application.

As evidence of proper credit and appreciation of this, is the fact that I enrolled with the same school for an additional course in American business law in April 1932. This course was also completed, and on more than one occasion the knowledge gained therefrom has caused me to steer clear of legal entanglements, which might have cost more than the course itself.

If there were no pecuniary benefit that I could definitely attribute to home study, the satisfaction that I have in knowledge so acquired is more than adequate compensation for time and money so spent.

—H. L. L., Macon, Ga.

"BEAUTY CULTURIST ON THE FACE OF NATURE"

Early in life my education was very limited. Up until I was twenty years of age I spent my spare time going to a little district school in the country. I would go to school during the winter months, and the balance of the year I would work on the farm and forget most of what I did learn. Thus my youth sped by and I failed to accomplish much in the way of education.

I wanted to go to the State Agricultural College, but time and means would not permit; neither was my education sufficient to carry out this desire. It was at this time I became interested in the correspondence study offered by the ———

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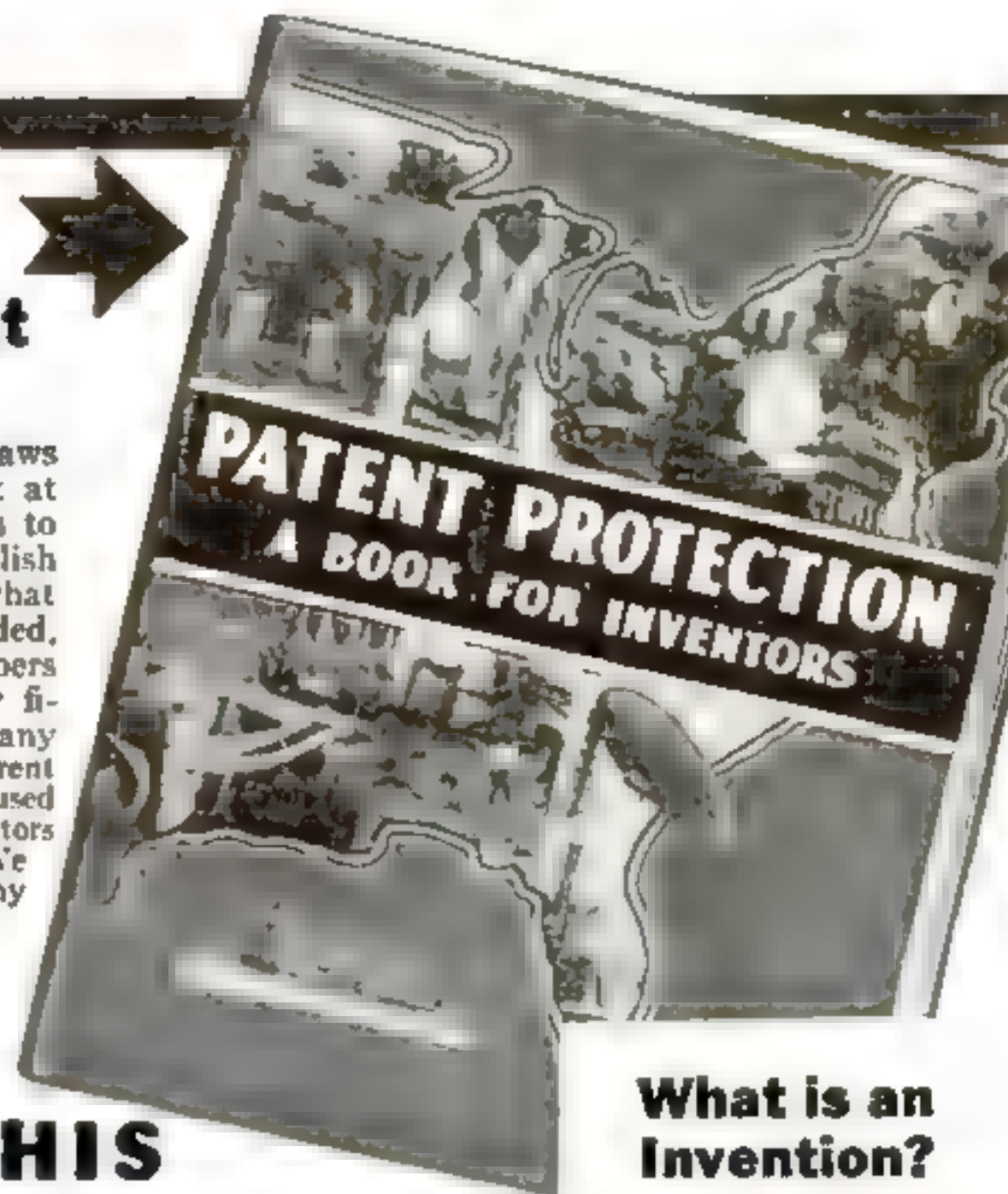
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Secrets of Success

Agricultural College and enrolled for two courses: "Fruit Growing" and "Propagation of Plants".

After taking these courses I became impressed with the idea that a person must have a pretty good education before he can realize how little he does know. Soon after completing these courses I went down into Florida; here I dabbled awhile in fruit growing, but lacking means and experience, I didn't acquire much but a bad case of malarial fever.

Well, I finally came out to California. Here I took another correspondence course, one in "Home Floriculture" from the University. I then spent two years as landscape gardener at Atascadero Lake for the Corporation of Atascadero, California. This was quite an important period in my life for it was here I married and went to live in a pretty little bungalow by the lake.

Later I attempted to buy a ranch in the San Joaquin Valley near Fresno, but lost out just at the beginning of the depression.

My correspondence education, however, helped me to secure the position I now hold—landscape gardener at the College. I have been on this job for thirteen years, and while it does not pay a large salary, it gives one an opportunity to work out-of-doors in the realm of Nature. I sometimes look on my work as a sort of beauty culture operation on the face of Mother Earth.

Since taking up my work here I have taken another correspondence course which I hope to make good use of in the future. This was a course in photography taken with the Studios, now known as the of Chicago, Illinois. Through the medium of photography, I hope some day to be able to impress on the public mind some of the right and wrong ways of planting trees, shrubs and flowers.

—P. G. S., Fresno, Calif.

STUDY DISEASES WITH TRANSPARENT ANIMALS

TRANSPARENT animals to aid in the study of bone disease are the accomplishment of a Bridgeport, Conn., Laboratory. The body of the animal is first hardened in a chemical bath, a process said to be similar to that used by the ancient Egyptians in preparing their mummies. Next, the hardened specimen is washed for a long period in running water. Any color that remains after this washing operation is bleached out in a strong bath of hydrogen peroxide. All water is then removed by prolonged soaking in specially prepared dehydrating baths. Finally, the transparent, colorless, body is soaked in a bath that stains the bones, but not the overlying organs. The biologist can then see the bones, healthy or diseased, in their exact relations to other tissues, making observations impossible with the ordinary method of dissection. Rats, fish, turtles, and other animals have been thus prepared, and individual human organs have been made transparent in a similar manner. It is said that the process could be applied to an entire human body, and it is expected that doing so might bring new knowledge of human anatomy.

SEX OF ALLIGATORS CHANGED IN TESTS

EGG-LAYING male alligators may be produced in the laboratory as the result of experiments carried on by two scientists at the University of Rochester, New York. Dr. Robert K. Burns, Jr., professor of anatomy at the medical school, and Thomas R. Forbes, his associate, have reported that injecting small doses of a female sex hormone, oestrone, into the bodies of young male alligators causes development of egg-laying organs and changes the sex of the saurians from male to female. Minute quantities of the gland extract are administered hypodermically. Similar treatments cause female alligators to reach maturity years before they would under normal conditions. The oestrone is obtained from the organs of slaughtered sheep and cattle. The work of the two scientists parallels that of Dr. Benjamin H. Willier, of the same university. By injecting a similar hormone into incubating eggs, he caused all those hatching to produce female chicks. Under normal conditions, the chicks run about half male and half female.

MINERAL CEMENT GIVES NONSKID FLOORING

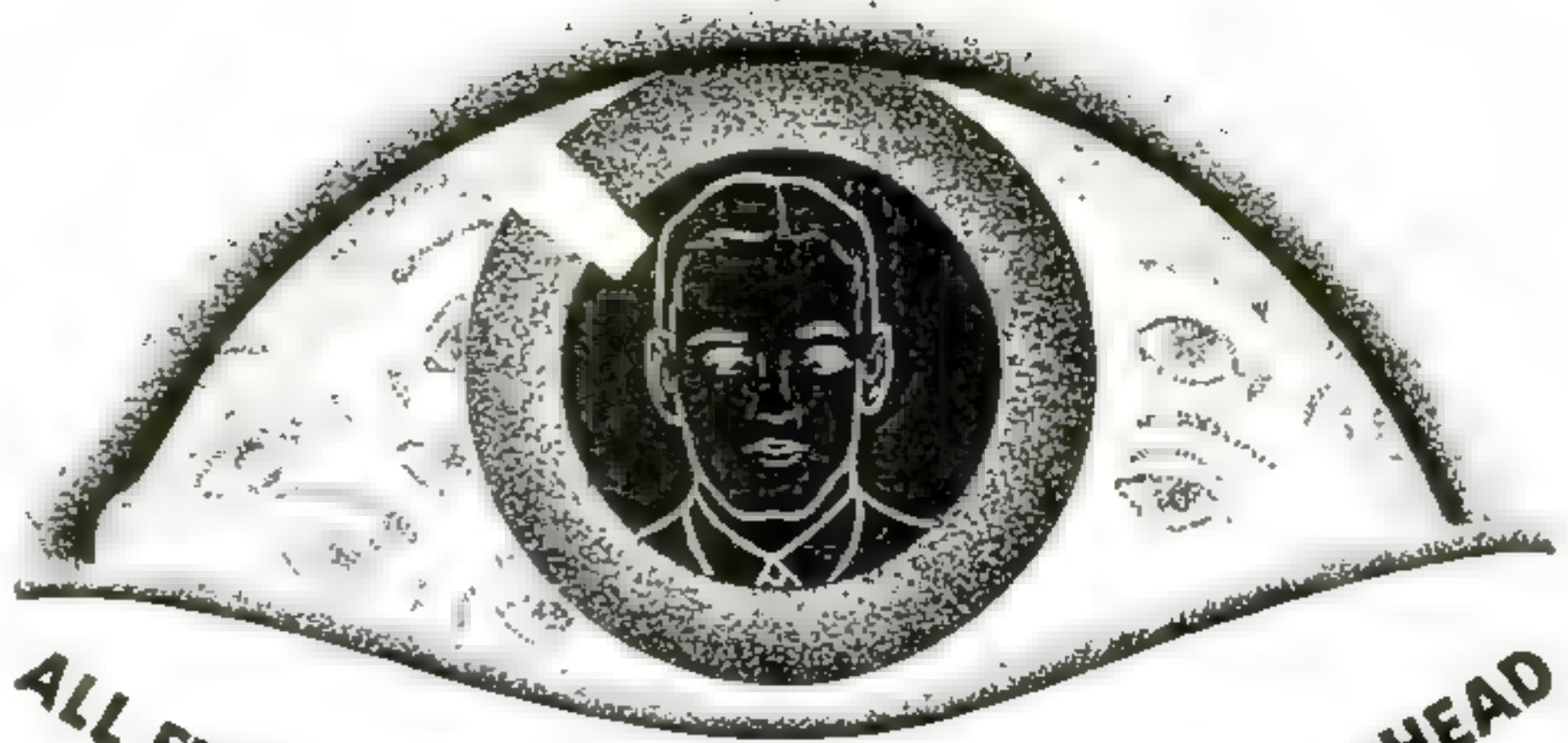
By ADDING powdered copper to concrete, experimenters at the Mellon Institute for Industrial Research, in Pittsburgh, Pa., have produced a new building material of unusual strength and resistance to wear. It is reported to be particularly useful for providing nonskid floor surfaces. During one test, coatings of the new material, from one eighth to one fourth of an inch thick, were spread over a smooth concrete walk. It adhered perfectly to the concrete below it and, after seven months of constant wetting and after more than 250,000 people had walked over it, remained in perfect condition. The new material can be mixed for troweling, brushing, or spraying, and is suitable for stucco and for coating a wide variety of materials.

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A NEW ISLAND recently popped above the waves of the Black Sea, off the Crimean coast near Balaklava, Russia. Scientists who reported the unusual event attributed it to a rare geological phenomenon. Centuries ago, they believe, the sea undermined an immense cliff which dropped into the water. Its weight caused the sea bottom at that point to buckle. Recent earthquakes in Caucasia, they say, have now pushed this fault above the water to form the island.

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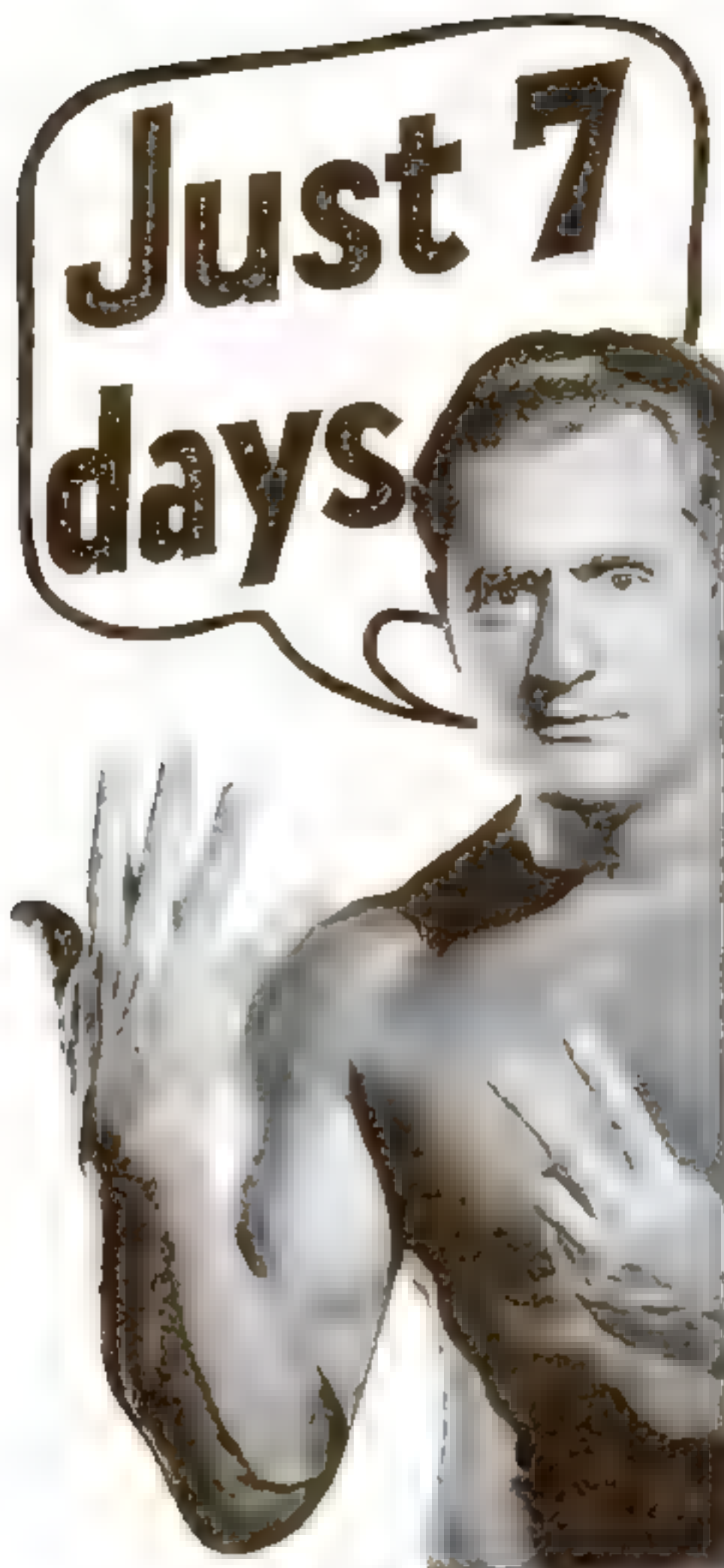
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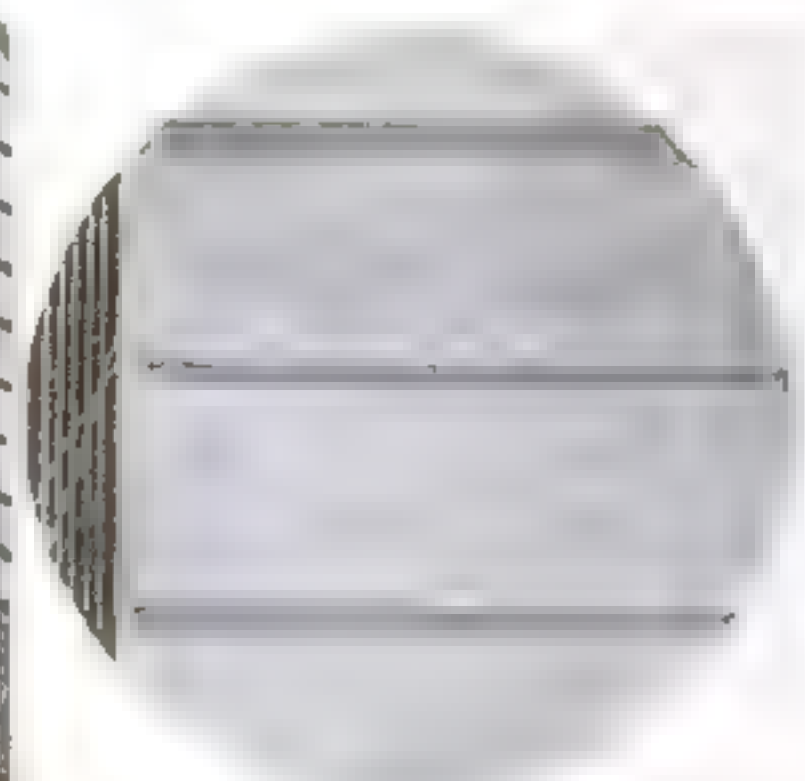


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Applying the new siding. The material can be cut to shape with a saw or knife, or with shears, as shown at the right



Graining gives the new asbestos clapboards the appearance of wood



New Ideas for Home Builders

MADE to look like weatherworn wood, composition clapboards now available provide a fireproof siding for use on old houses as well as new. Composed of Portland cement and asbestos, the new clapboards have a lasting white color and an artificial grain that makes them particularly suited for use on Colonial-type houses. The siding is sold in eight-foot lengths, nine and one half inches wide and three sixteenths of an inch thick, and is

designed for an overlap between adjacent strips of one and one half inches. It is easily applied to the walls with nails and can be cut with a sharp knife, a saw, or large-size, hand-operated shears made especially for the purpose. As shown in the large photograph above, the material can be put in place directly over a layer of tarred sheathing or building paper. When applied like wood clapboards, the new siding cannot be distinguished from them.

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Questions

FROM HOME OWNERS

Q.—SOME clear glass vases in which we keep flowers have a white film on the inside. We have been told that it is caused by the hardness of our water. What will remove this film?—C.C., Wichita, Kans.

A.—SOAK the vases in a weak solution of muriatic acid (about one part acid to twenty parts water.) Then rinse them thoroughly several times in clean water.

Streaks on Window Pane

Q.—DURING our absence from home some practical joker marked on the glass of one window with something that looks like paraffin. We have tried to remove the marks by scraping with a razor blade, and by washing with soapy water, ammonia, gasoline, and other cleaners, but with no success. Can you suggest any way we can get rid of these annoying streaks?—M.C.W., Tucson, Ariz.

A.—SINCE you do not know the definite cause of the streaking, it is difficult to give a formula (Continued on page 14)



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QUESTIONS FROM HOME OWNERS

(Continued from page 13)

that is certain to remove the marks. However, you might try applying a diluted solution of nitric acid, wiping it all over the pane. Allow it to act for a minute, and then throw on enough pulverized whitening to cause a hissing sound. Rub the entire glass, polish with a dry rag, rinse with clear water and a little alcohol, and then polish dry. The nitric acid should remove all the impurities on the glass.

Preparing To Reshingle Roof

R.K.I., COLUMBUS, OHIO. Since both wood and composition shingles are comparatively light in weight, it is probably not necessary to increase the roof bracing when reshingling with either material. However, if you plan to use some heavier roofing such as slate or tile, it would be wise to support the additional weight by adding cross braces and tie boards to the rafters.

Dampproof Cellar Walls

P.D., CHARLOTTE, N.C. Cellar walls can be made practically dampproof by applying a coating of kerosene and melted paraffin. The proportions are one and a half pounds of paraffin to a gallon of kerosene. Warm the latter carefully to about eighty degrees F., and then add the paraffin in small bits.

Guarding Against Poison Ivy

Q.—I have heard that the safest way to get rid of poison ivy is to uproot the weed and then bury the remains under a layer of salt. Is there any good protective solution to apply to the exposed face and hands while destroying the ivy? D.L., Morristown, N.J.

A.—Apply the following solution to all exposed parts of the body: one half pint of water, one half pint of glycerin, and three quarters of an ounce of iron chloride. Let this mixture dry on the skin.

Covering Cedar Shingles

N.W.B., CHARLESTON, S.C. As a general rule, stain is better than white lead and oil as a covering for cedar shingles. The latter keeps the shingles from drying and thus may cause them to rot.

For Renovating Screens

A.R.N., FLINT, MICH. Boiled linseed oil, mixed with a little turpentine and enough lampblack to give it color, is a good renovating liquid to use on screens that have been stored through the winter. Apply the mixture with a close-grained sponge instead of a brush.

Plastering Over Wood Lath

B.M.E., WATERTOWN, N.Y. Before applying plaster over wood lath, the latter should be thoroughly wet. This will keep the wood from swelling later on and causing the plaster surface to warp and crack.

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(Continued on page 16)



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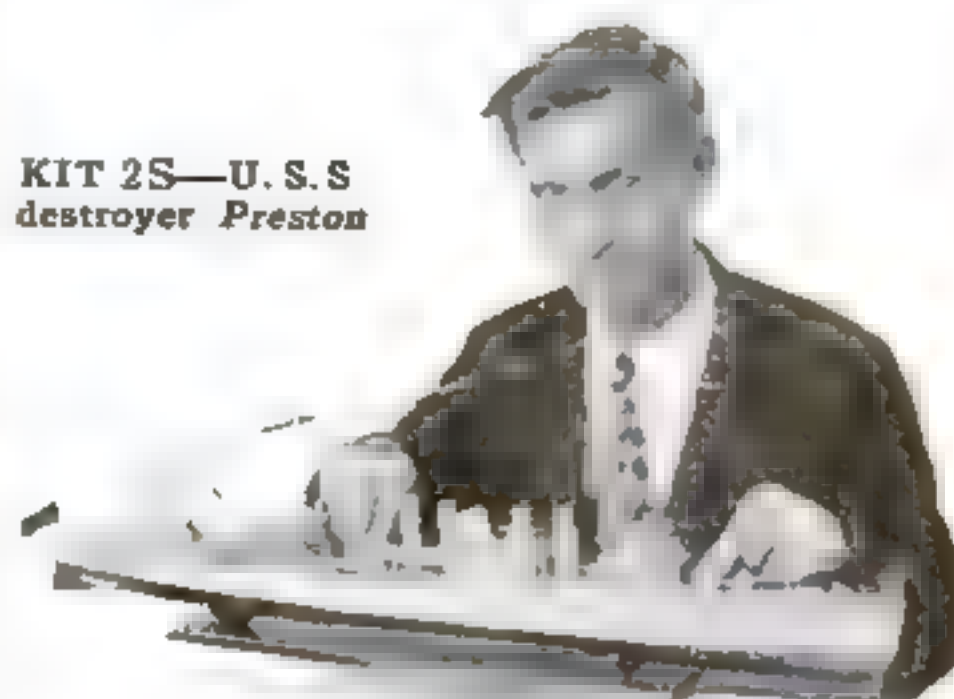
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OUR CONSTRUCTION KITS

(Continued from page 15)

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(Continued on page 17)



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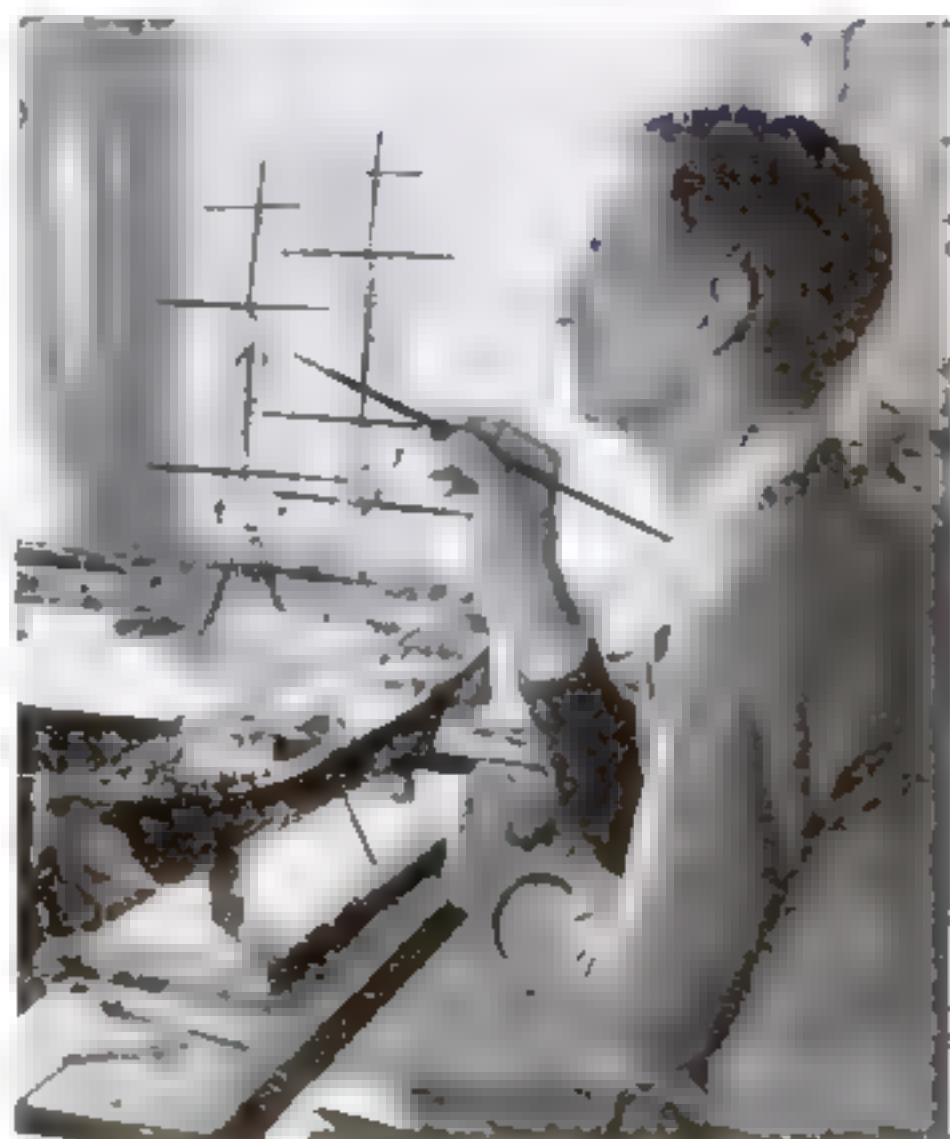
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OUR CONSTRUCTION KITS

(Continued from page 16)



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JUNE 1937

POPULAR SCIENCE

VOL. 130: NO. 6

Engineers Turn Detectives TO SOLVE MYSTERIOUS ACCIDENTS



This plane plunged into the water and a microphone fell and jammed the controls.

**WORKING IN THE WAKE OF DISASTER, EXPERTS
COMB WRECKS AND RUINS FOR TELLTALE CLEWS
THAT WILL HELP TO MAKE OUR LIVES SAFER**

By Andrew R. Boone

SCREAMING through the air at three miles a minute, an airliner crashes to the ground and strews wreckage across a twenty-acre field. With a roar that carries for miles, a building explodes like a giant bomb. Flames, shooting a hundred feet into the air, turn a factory into smoldering debris.

In the wake of such disasters, engineering sleuths begin their work. These experts ferret out the causes of mystery crashes, fires that start themselves, blasts of unknown origin. Through amazing feats of scientific detection, in which they uncover clues written in twisted steel, charred wood, and melted glass, they put their fingers on weak links in the chain of safety. Their work, little-known but vital, makes the world safer for us all.

A few weeks ago, when the oil-field school at New London, Tex., shattered like a grenade, killing 427 children and teachers in one of the worst school disasters of history, only torn and twisted wreckage remained. Yet, working from clue to clue, an explosives expert quickly traced effects to cause.

Dr. Eugene P. Schoch, University of Texas chemical-engineering professor, was the man called in to solve the mystery of the blast. Different explosives leave their "fingerprints" in the form of their manner of shattering, and in the area where damage is greatest. Thus, an expert can tell whether dynamite, gas, or nitroglycerin produced the detonation.

Dr. Schoch studied the positions of timbers and girders; he talked with survivors; he determined from fragments of the walls that the explosion had come from within. In the end, he was able to demonstrate exactly how the catastrophe had occurred. Gas, escaping into the basement, had seeped up through the hollow walls of the structure and had been ignited by a spark from an electric switch in the manual-training room. In



The broken safety net that dropped ten men to death off the Golden Gate Bridge. Right, state officials examining the suspension members of the scaffold.



the future, as a result of his diagnosis of the disaster, the walls of public buildings in Texas will be sealed against escaping gas.

Other recent calamities, taking their toll of lives and property, have brought riddles of many kinds for the engineering sleuths to solve.

Two hundred and fifty feet above the water of San Francisco Bay, for example, workmen were riding a traveling scaffold, not long ago, as they removed forms from beneath the roadway of the new Golden Gate Bridge. Far below, two small boats rolled gently in the mild swells as they headed into harbor. Suddenly, there was the sharp crack of breaking metal. The jests of the workmen changed to agonized shouts. Ripping from its moorings, the ten-ton scaffold crashed, with its load of human beings, into the safety net below. Like the rat-a-tat of a machine gun, the net broke its lashings, one by one, until a 2,100-foot section, stretching from the south tower to the center of the bridge, had torn away, dropping the men to death in the water below.

In less than an hour, L. K. Reinhardt,

construction engineer of the state accident commission, and his fellow experts were crawling like flies over and under the bridge deck. They inspected I beams, fastenings, and net supports. They took moving pictures for later study. They scrutinized the frayed ends of the net lashings. And, finally, they carried aluminum castings and parts of the scaffold hangers to the laboratories of the University of California, broke them apart, and found imperfections which had contributed to the death of ten men.

Because of the terrific speed involved, and the resulting breakage, airway crashes are often among the hardest to unriddle. Probably the best piece of engineering detective work in recent years was that which cleared up what promised to remain

an unsolved mystery—the crack-up of an airliner almost within sight of the San Francisco field.

Carrying eight passengers, homeward bound from Los Angeles, the big plane roared over the Municipal Airport and circled for a landing. The two 1,150-horsepower engines were ticking in unison as the ship disappeared in the darkness. A moment later, the copilot reported by radio. All was well. Minutes lengthened. Hours went by. The plane had vanished.

Later, the wreckage was discovered in shallow water at the edge of the bay. Every person aboard was dead. What had happened? Had an engine stopped? Had a propeller snapped? Had the pilot misjudged his altitude in the dark? Had he fainted, or died, and fallen against the

Ruins of the New London, Tex., consolidated school after the explosion in which 427 pupils and teachers lost their lives. Gas seeping through the walls was blamed





Mystery surrounded the crash of this giant airliner until scientific sleuths discovered ridges of ice on aileron edges, shown at the right

controls? No solution seemed possible.

Half a dozen experts swung into action in an attempt to find the answer. They included H. O. West, chief engineer of the air line, William Mentzer, resident engineer at the factory where the big ship was built, Major R. W. Schroeder, pioneer Army flyer, David Behncke, president of the Air-Line Pilots Association, and inspectors from the U. S. Department of Commerce.

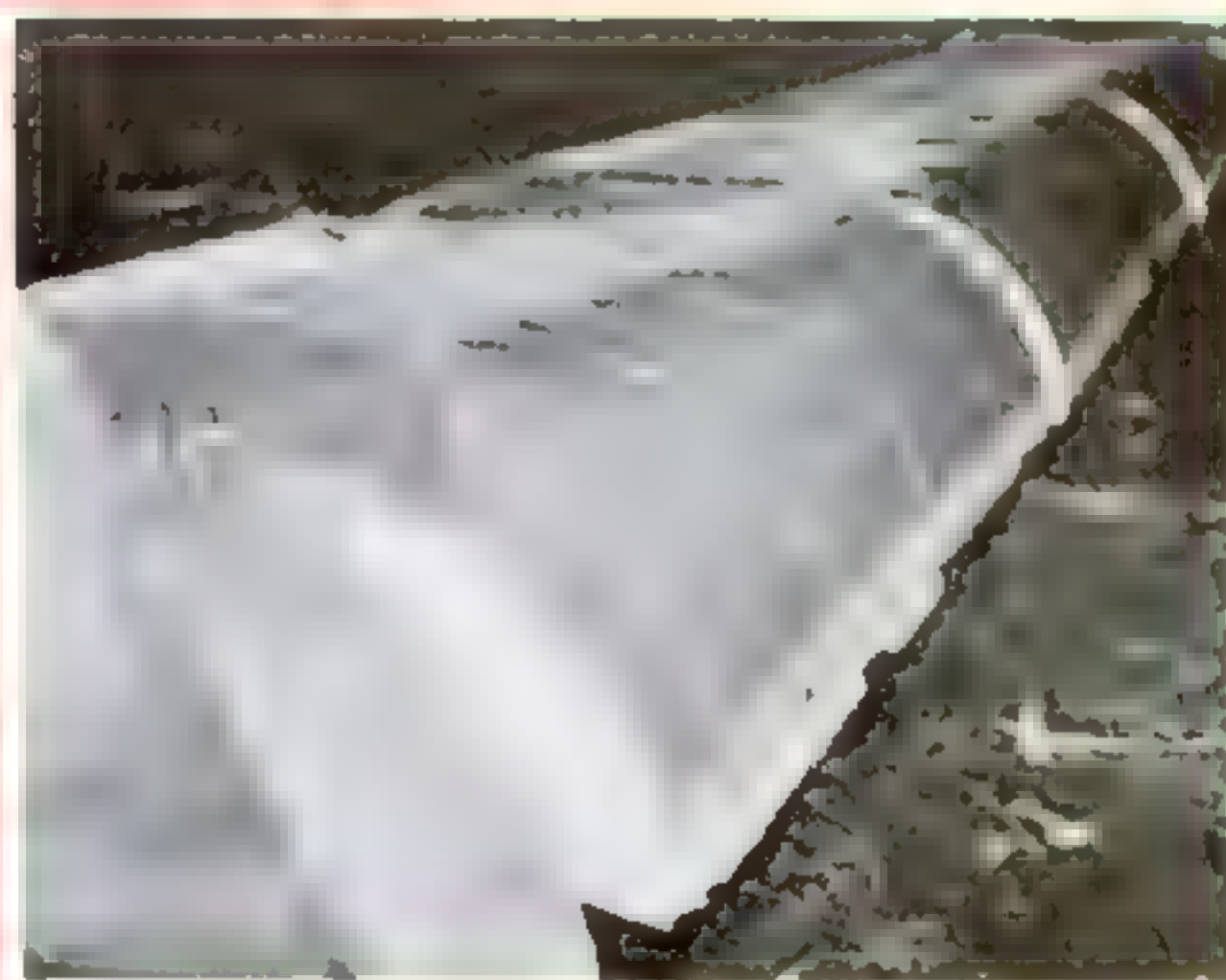
For nearly two weeks, three launches cruised back and forth over the spot where the airliner had crashed. Each dragged along the bottom of the bay a 700-foot line carrying 450 halibut hooks. These grappling lines brought to the surface even the smallest fragments of the wrecked machine.

Each bit of metal was studied in the search for clues. The engines were taken apart, and every fitting examined. The twisted steel propellers were scrutinized

under the microscope. The shattered right wing was gone over, piece by piece.

An early phase of the investigation was the examination of blood samples from the bodies of the pilot and copilot. Experts studied them for the presence of alcohol or habit-forming drugs. So delicate were the tests they used that they revealed that the pilot had taken an aspirin tablet several hours before the crash.

In going over the wreckage of the cabin, one of the engineers made an important find. He noted that fragments of the copilot's microphone were lodged behind the steering column. On the base of the microphone were smears of black paint. Chemical analysis revealed that it was the



same kind of paint as that used on the control column. Had the microphone slipped from the copilot's fingers and jammed the controls so they could not be pulled back to lift the nose of the plane?

The answer hinged on whether a similar microphone could be crushed by pulling back on the control wheel of a similar plane. To find out, pilots and engineers jammed duplicate microphones behind the control column. Tug as they would on the wheel, the pilots could not crush the instrument. The secret of the tragedy had been found. And, in finding it, the investigators removed one more hazard. For, now such microphones are suspended from strong cords which swing them safely against the side of the cabin when they are not in use.

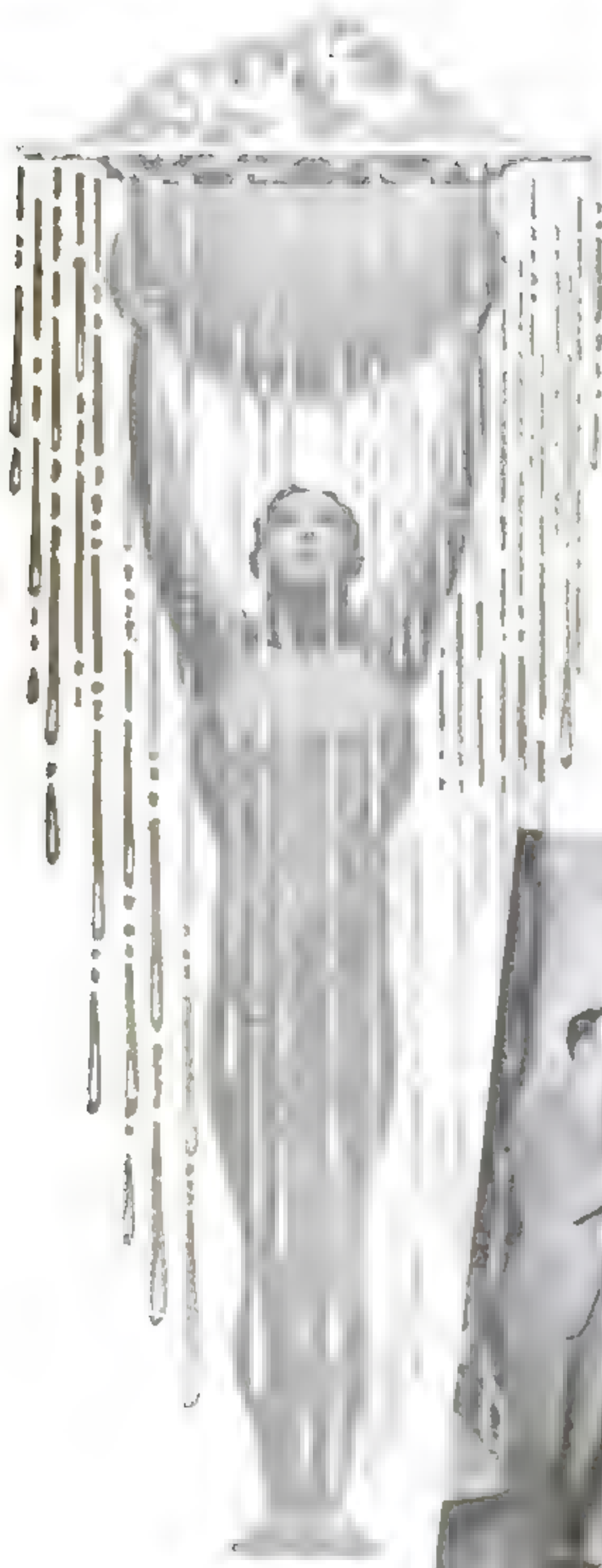
Twice, within recent weeks, Pittsburgh, Pa., has been the scene of puzzling air crashes. In both cases, aeronautical experts ferreted out unusual clues which cleared up the mysteries.

In one instance, a big skyliner, arriving from Newark, N.J., was within five miles of the airport when it suddenly nosed down, spun twice, and crashed into a narrow valley. Thirteen persons aboard were killed instantly. Investigators discovered curious ridges of ice between the ailerons and the wings. Freak weather conditions had caused their *(Continued on page 110)*



Rescue workers of the U. S. Bureau of Mines about to enter a mine after an explosion. Underground accidents are studied by state and Federal experts

Is 'Heavy Water' the Fountain



By
GROVER
C.
MUELLER

ADD ten years to your life! That is the fascinating hope held out to men and women by a magic new fluid called "heavy water," according to Dr. James E. Kendall, head of the department of chemistry at Edinburgh University, Scotland. Discovered only six years ago, it may soon be sipped by everybody, he foresees, as a means of prolonging the human life span.

Once chemists supposed the water that flows from your faucet to be as pure and "straight" a drink as could be found. Then, in 1931, came the startling revelation that the world's most popular beverage is actually a mixture or "blend." Through a costly electrical process, 6,000 parts of tap water can be separated into 5,999 parts of ordinary water and one part of "heavy water." They look alike, but there the resemblance ends.

Ten glassfuls of heavy water

outweigh eleven glassfuls of ordinary water. Heavy water boils at a temperature three degrees higher, and freezes at a temperature seven degrees higher, than the common variety. Unlike the tasteless water you are accustomed to drink, heavy water has a sweetish flavor.

Would heavy water prove an elixir of life, a deadly poison, or a neutral substance like ordinary water? Daring experimenters have swallowed small amounts of it without ill effects. But mice fed with relatively larger quantities of the mysterious liquid died, as did tadpoles and small fish placed in tanks of it. Why? Nobody knows for sure, as yet, but chemists have discovered one significant clew. Many chemical reactions, they have observed, take place more slowly in heavy water than in common water. Thus heavy water may "apply the brakes" to life processes, with more or less effect according to the amount consumed.

Here is the basis of Dr. Kendall's bold idea. By taking carefully regulated quantities of this heavy water, perhaps an elderly person could "throttle down" his internal mechanism thereby making it last



MODERN ALCHEMISTS SEEK ELIXIR OF LIFE

Experimenters at Pennsylvania State College, State College, Pa., and the equipment used in a recent attempt to manufacture "heavy water" on a large scale. The chief drawback in the use of the strange substance is its present high cost. In the photograph below, the scales show the difference in weight between equal volumes of "heavy water" and of plain water



of Youth?

longer by preserving it from all unnecessary wear and tear!

"In other words," Dr. Kendall says, "the person drinking heavy water would be living only half as fast as the person drinking ordinary water. Doubtless, this would have drawbacks to men and women of working age, but it would be a positive boon to those in the Indian summer of life, who have retired from active work and wish only to enjoy the fruits of their labors."

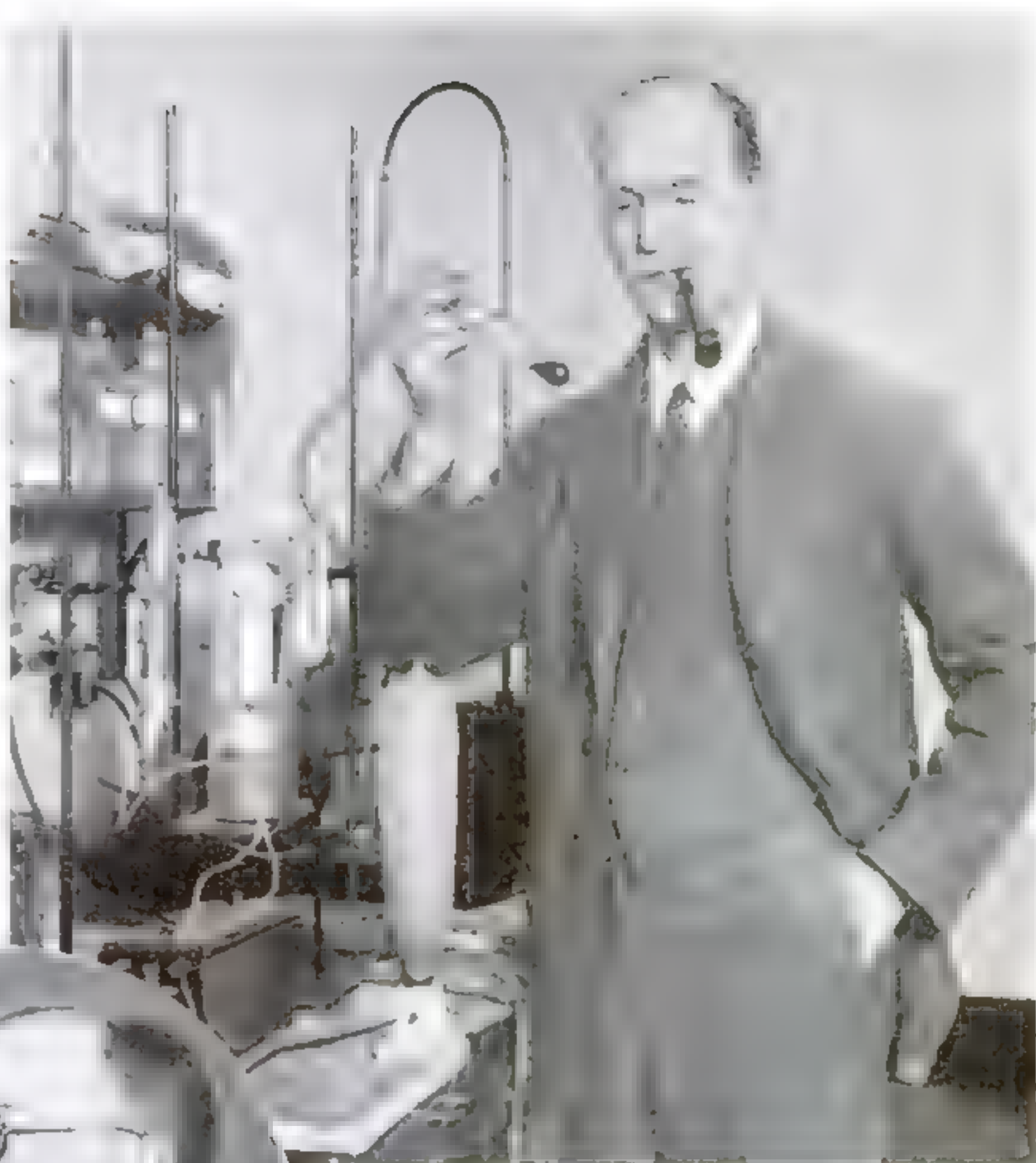
"The heavy-water drinker's reactions would probably be slowed, and possibly his mental processes also, but who wants to be fast at sixty? Fantastic as this development may sound, I believe that within the next ten or fifteen years drinking of heavy water by those who have passed sixty, as a means of prolonging the 'reward years' of life, will be commonplace."

One formidable obstacle to be overcome, he admits, is the cost of producing heavy water. Scarcer than the rarest wine, it once sold for \$300 a teaspoonful, and even today the same outlay will buy only a couple of glassfuls! At the current price, a year's supply for drinking purposes would bankrupt a millionaire. If heavy water proves desirable for human consumption, a cheaper method of extracting it must be found, and Dr. Kendall predicts that this will be discovered within the next few years.

In the principal method used at present, vast quantities of water must be decomposed electrically into hydrogen and oxygen gas. A tiny residue of heavy water remains. Heavy water also can be separated from or-



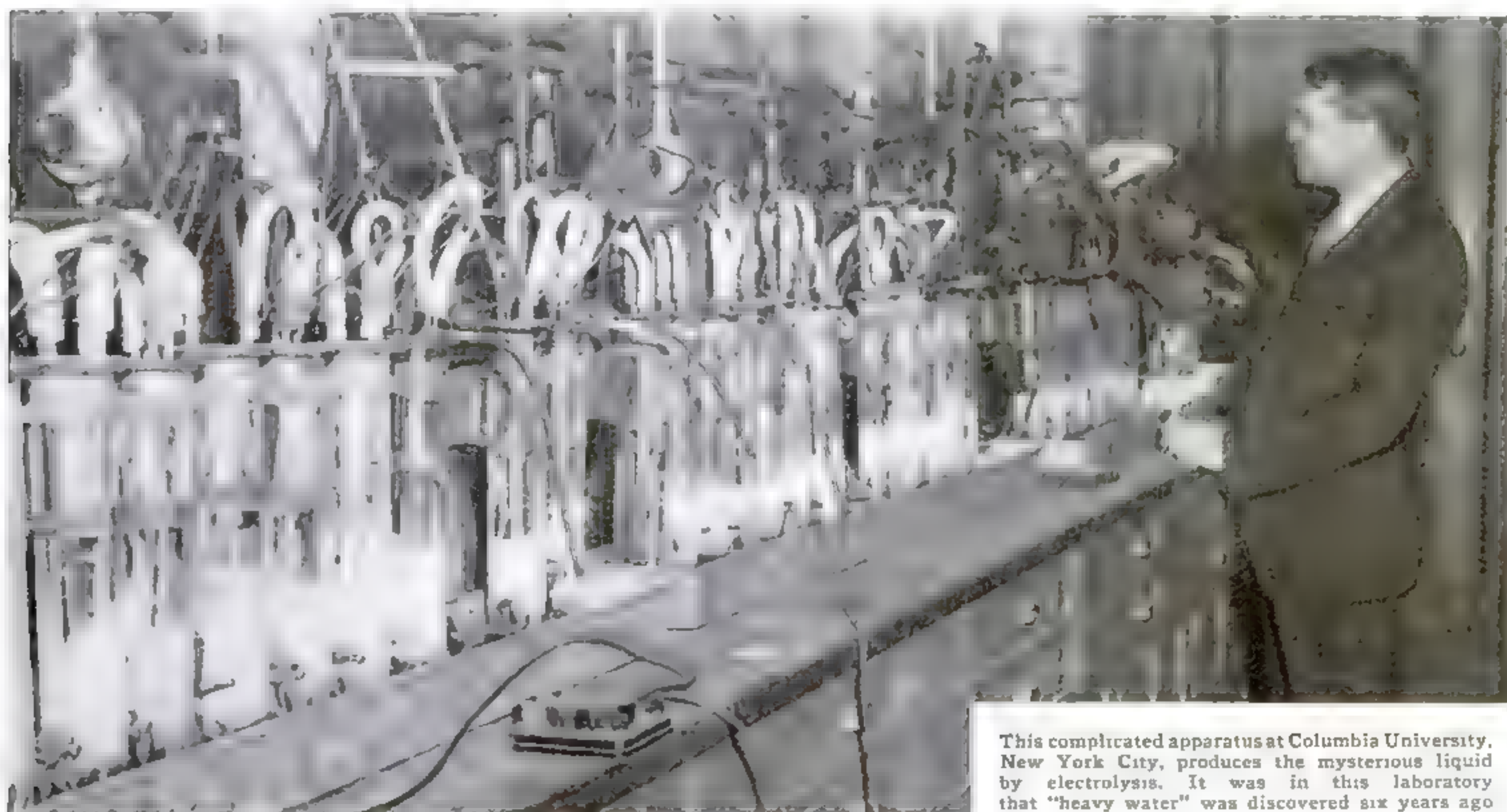
Increasing amounts of "heavy water" have been sipped by Prof. Klaus Hansen to test its effect



Dr. James E. Kendall, the British scientist who advanced the startling theory that "heavy water" might prolong life

dinary water by repeated distillation, and experimenters are seeking to develop an automatic still for manufacturing it as an inexpensive by-product of steam-making in commercial power houses. Another hope lies in the discovery of some substance that will isolate the atoms of heavy-water molecules by a single chemical reaction.

If further tests justify Dr. Kendall's daring theory, science will have approached the ancient alchemists' goal of an "elixir of life."



This complicated apparatus at Columbia University, New York City, produces the mysterious liquid by electrolysis. It was in this laboratory that "heavy water" was discovered six years ago

Anton Schrod, Austrian sculptor, and the elaborate miniature cathedral he modeled out of paper

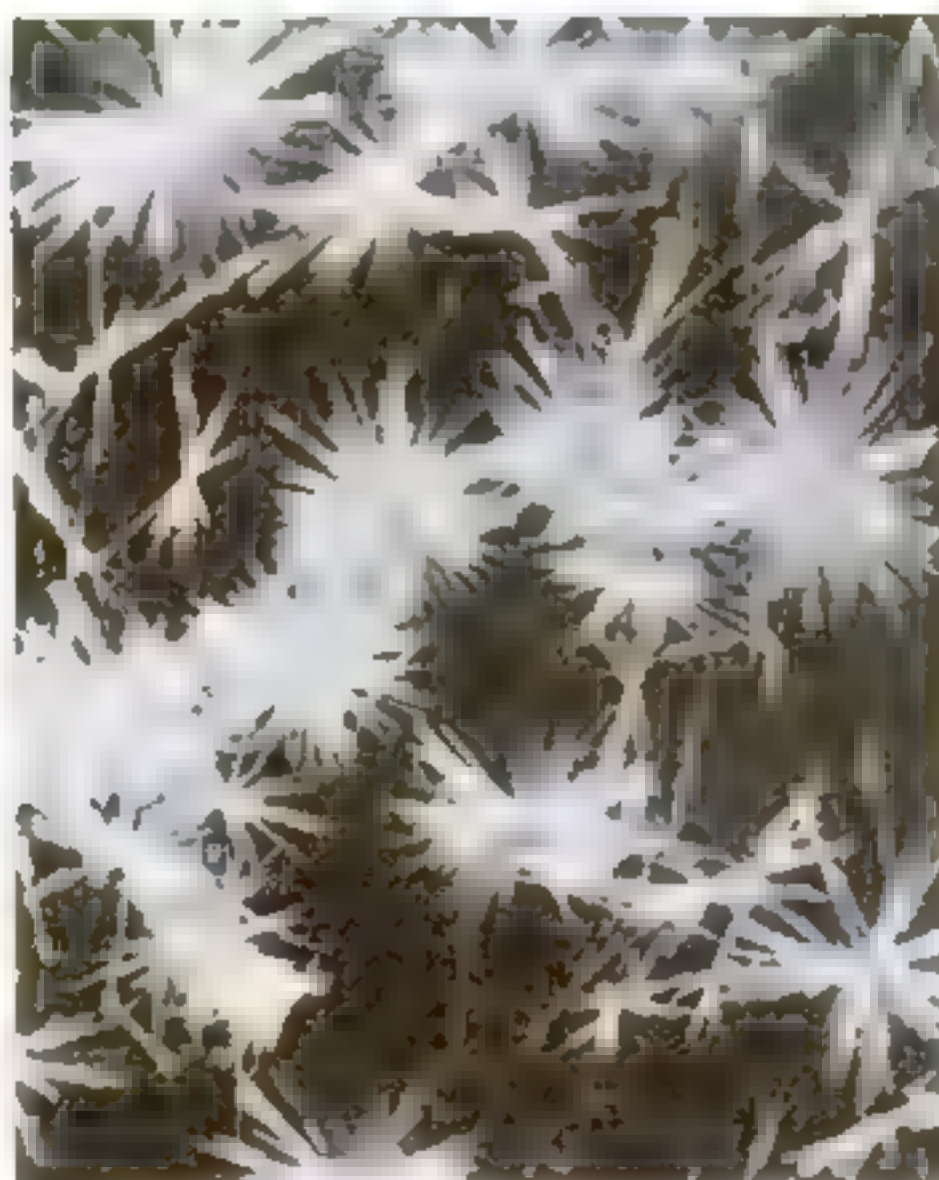


PAPER REPLACES STONE IN NOVEL SCULPTURE

USING paper instead of stone as a medium, an Austrian sculptor, Anton Schrod, has been achieving unusual and striking effects. An exhibit of his work, held recently in Vienna, attracted wide attention. One of the outstanding pieces on display was a reproduction of a huge and ornate cathedral.

ODD PHOTOGRAPH SHOWS HOW VITAMINS LOOK

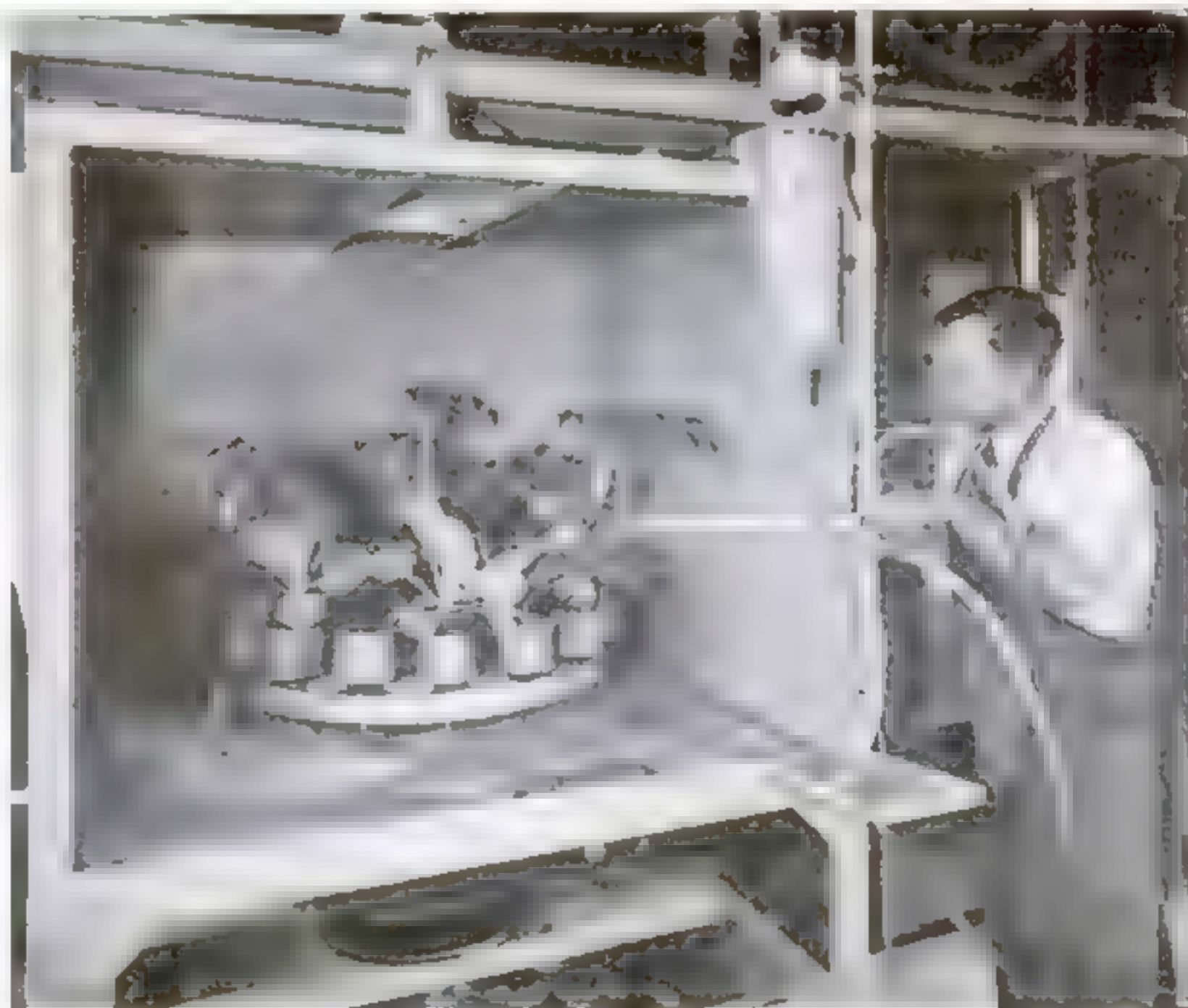
SUGGESTING a night picture of bursting rockets, one of the most perfect photographs ever obtained of the "nerve vitamin," B1, was made recently by two scientists at Fordham University, New York City. A two-minute exposure produced the negative, which was enlarged twenty times. The vitamin shown is found in fresh vegetables, liver, eggs, and milk.



The "nerve vitamin," B1, as seen by the camera

INSECTICIDES TESTED IN ODD CABINET

A LABORATORY merry-go-round, carrying potted plants past an insecticide spray gun three times a minute, is part of the equipment for determining the relative effectiveness of insect poisons at the new Du Pont Pest-Control Laboratory, Wilmington, Del. Every time the table revolves once, fingers which hold the pots make a third of a turn, to insure uniform application of the spray. Later, the plants are placed in cages holding injurious insects, and the reaction of both plants and insects is noted.



Plants being sprayed with an insecticide as they are carried around on a turntable



AUTOMATIC FILLER FOR CAR BATTERY

AN AUTOMATIC filler for automobile storage batteries consists of three bottles in a unit mounted under the hood. Gravity carries the distilled water through rubber tubes to the cells and maintains the correct level.

AMATEUR BUILDS RARE-TYPE TELESCOPE

A TELESCOPE of one of the rarest types known, the "Gregorian" instrument first described in 1663 by James Gregory, has been completed by R. S. Fozer, a Michigan amateur astronomer. The telescope is only about two feet long, but, because of the optical arrangement of the reflecting mirrors within the tube, is said to equal an ordinary eight-foot instrument. However, the difficulties of construction are so great that few of the telescopes are in existence, and most of those in museums.



Gregorian-type telescope and its builder, R. S. Fozer, Michigan amateur



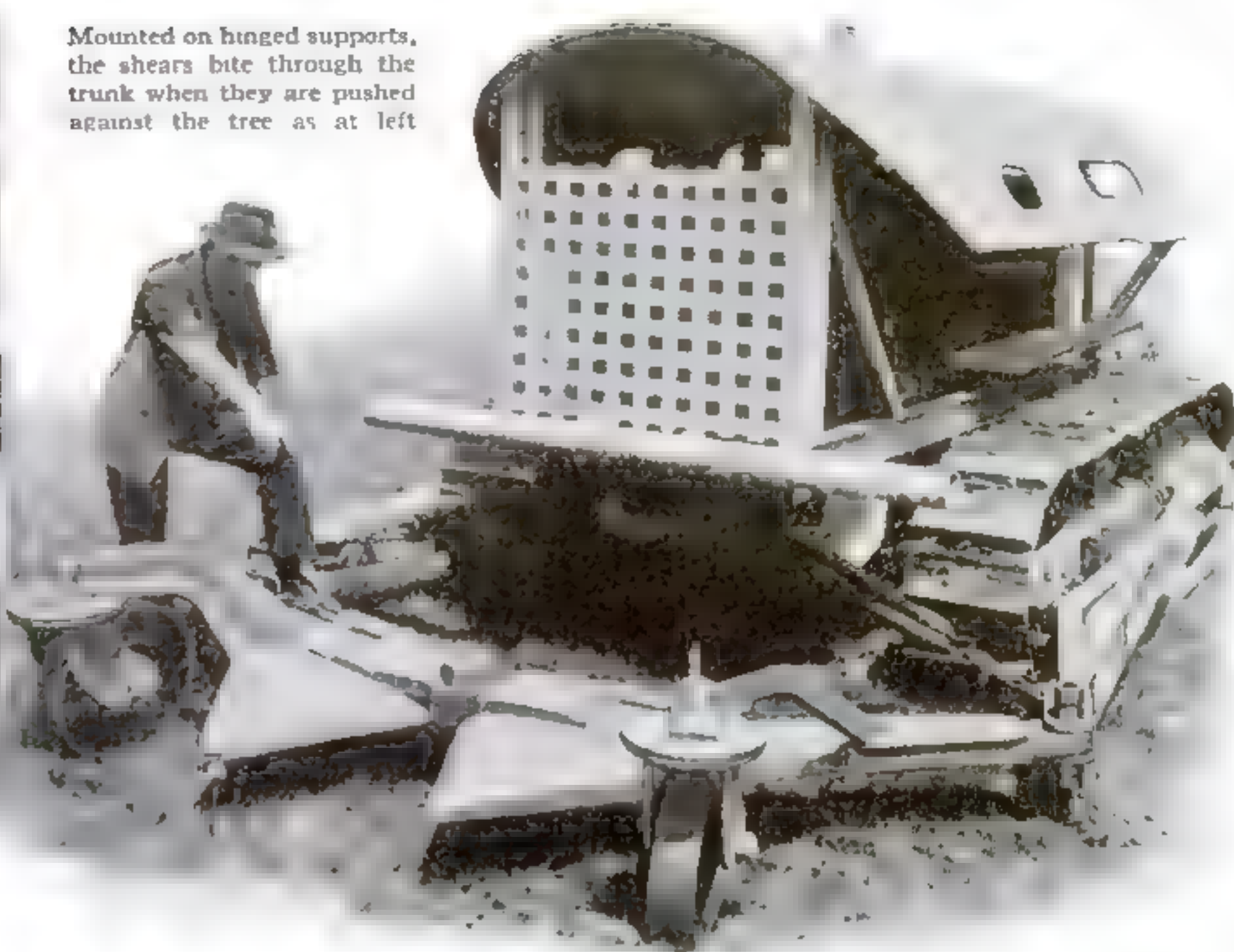
CHIPS AID BRIDGE FANS IN KEEPING SCORE

REPLACING the pad and pencil for keeping bridge scores, thin metal chips—some round, some square—now speed up the game. The scorekeeper gives each player chips totaling 5,000 points, at the beginning of the game. Square chips are used by the banker for keeping the game score.

GIANT SHEARS ON ARMORED TRACTOR CUT DOWN TREES



Mounted on hinged supports, the shears bite through the trunk when they are pushed against the tree as at left



SNIPPING its way through a forest, an odd tree cutter mounted on an armored tractor is said to do the work of 200 men. Two triangular shear blades are so mounted on hinged supports in front of the tractor that when they are pushed into contact with a tree trunk, they bite their way through the wood like giant scissors. The device fells trees almost two feet thick.

BATHING SUIT IS MADE OF SHEET COPPER

SETTING a new style in women's beach wear, the novel one-piece bathing suit shown in the photograph at the left is made entirely of sheet copper. Thin as cloth and almost as flexible, the shiny metal swimming costume was exhibited recently at a style show held in Bisbee, Ariz., widely known as "the copper city," and demonstrates new refinements in copper working.



Thin, flexible copper sheets were used to make this suit



GLOBE OF HEAVENS AIDS AMATEUR STARGAZERS

A CELESTIAL globe just introduced for amateur astronomers is a star finder as well as a map of the heavens. By a few simple adjustments, stars on the globe can be made to reveal their true positions in the sky as seen from any place in the world, at any hour of the night.

NONKINK PHONE CORD IS ELASTIC



A TELEPHONE cord of new design automatically shortens itself when not in use. Constructed around a central elastic core, the cord has a special, braided insulating covering that stretches, while the actual connecting wires are coiled inside.



Being elastic, the new phone cord shown in detail above at the left shortens itself when not in use and eliminates any possibility of kinking, looping, or tangling. Connecting wires are coiled inside

NEW COOLING PROCESS IMPROVES RAILS

RAILROAD rails treated by a new cooling process can be twisted like a corkscrew without breaking. In the last stage of their manufacture, the rails are cooled from about 1,900 degrees F. down to approxi-

mately 1,000 degrees, and then reheated. This added step is said to produce a fine grain structure within the steel and to improve its ductility and toughness. The rail shown below has been given three turns.



This rail, treated by a new cooling process, has been twisted through three complete turns



TABLE HELPS SET BROKEN BONES

ADJUSTABLE to any height, and fitted with hinged supports for arms and legs, a novel "anatomical" table designed by a Seattle, Wash., surgeon is said to facilitate the treatment of any type of bone fracture.

Tubular bars are moved by crank-operated gears to arrange the apparatus in the most advantageous position. A dummy is shown on the table in the photograph above.



Rubber replaces metal in the base and lens frame

RUBBER FLASH LIGHT

A NEW type of flash light just marketed has a base and lens frame made of lacquered rubber. Although designed especially for use by electricians to protect them against accidental contact with live wires, the rubber light also is free from corrosion and is practically unbreakable, the rubber cushioning any shocks if the accessory is dropped.

WRENCH HAS EXTRA STRENGTH



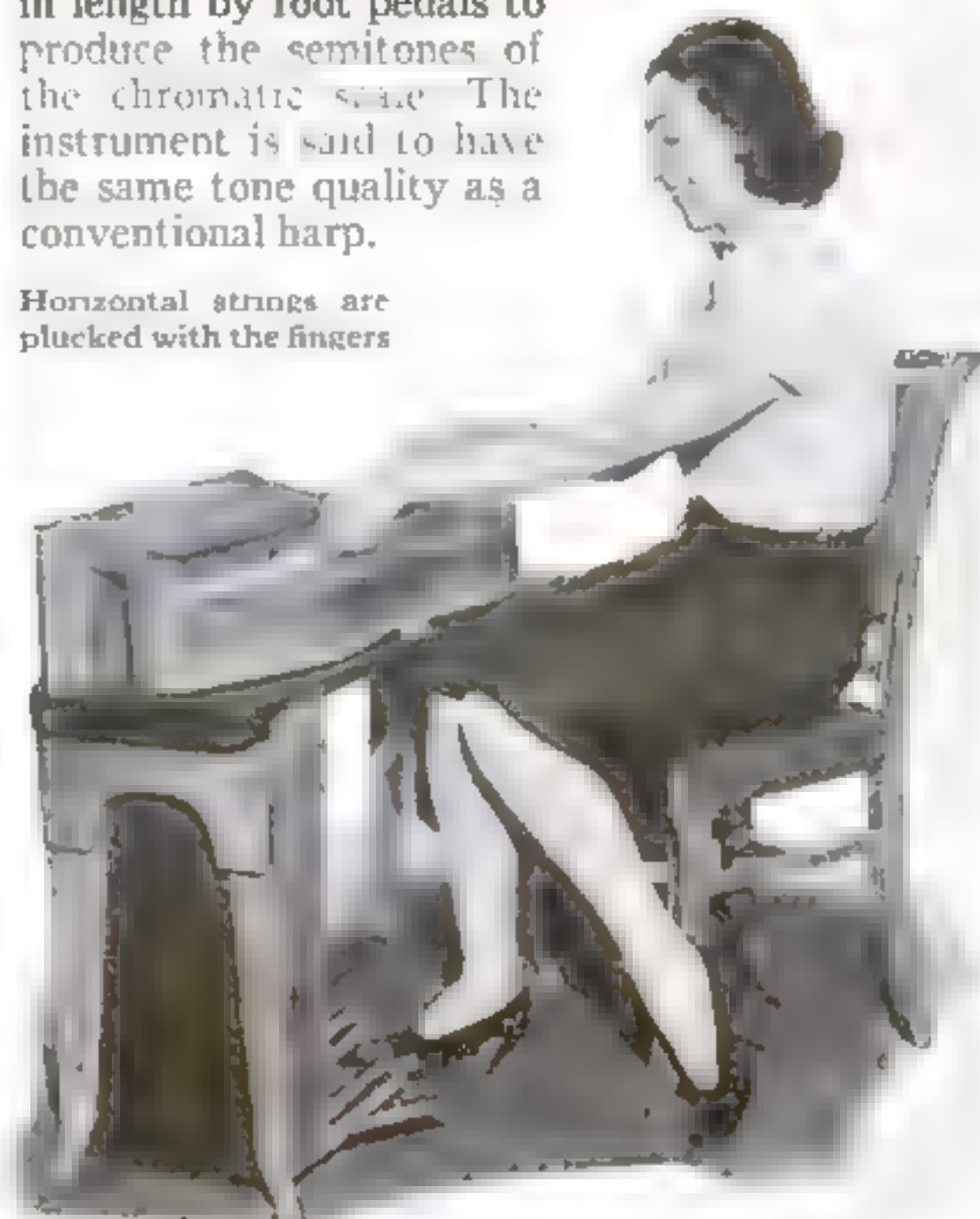
This photograph illustrates the strength and holding power of the new wrench. It is supporting the weight of ten men

EXCEPTIONAL strength and utility are claimed for a reversible ratchet wrench recently marketed for heavy-duty work. Instead of the customary two pawls, the new tool has four, and its gear has twenty instead of the usual sixteen teeth. The wrench is fitted with a socket that has a hole clear through the center, so that nuts may be turned on bolts of any length. It is made in five sizes, for jobs of varying difficulty.

TINY NEW CONSOLE HARP PLAYS IN ANY KEY

PLAYING in all keys like a full-size instrument, a new type of harp recently invented is housed in a compact console cabinet. Strings mounted horizontally are plucked with the fingers and adjusted in length by foot pedals to produce the semitones of the chromatic scale. The instrument is said to have the same tone quality as a conventional harp.

Horizontal strings are plucked with the fingers



The tripod adapter in use with a box camera. The clamp can be adjusted for size

Below, a folding camera set for a vertical picture



HANDY TRIPOD ADAPTER HOLDS ANY CAMERA

CAMERAS not equipped with special sockets for the purpose can be held on a standard photographic tripod by a handy adapter just introduced. Made of aluminum, the device holds cameras of various sizes firmly in place by means of an adjustable clamp screw, and permits taking pictures at unusual angles.

CAST ARTIFICIAL STONE

ARTIFICIAL STONE for building purposes is being produced in England and Russia by melting fragments of granite and trap rock, and casting the molten material in molds. Floor tiles and curbstones have been made from the artificially produced material. The process makes use of scraps of otherwise useless stone, and, it is expected, will become commercially important if a cheap source of fuel can be found.

PHOTOGRAPH SHOWS HOW CAR'S SPRINGS ABSORB SHOCKS

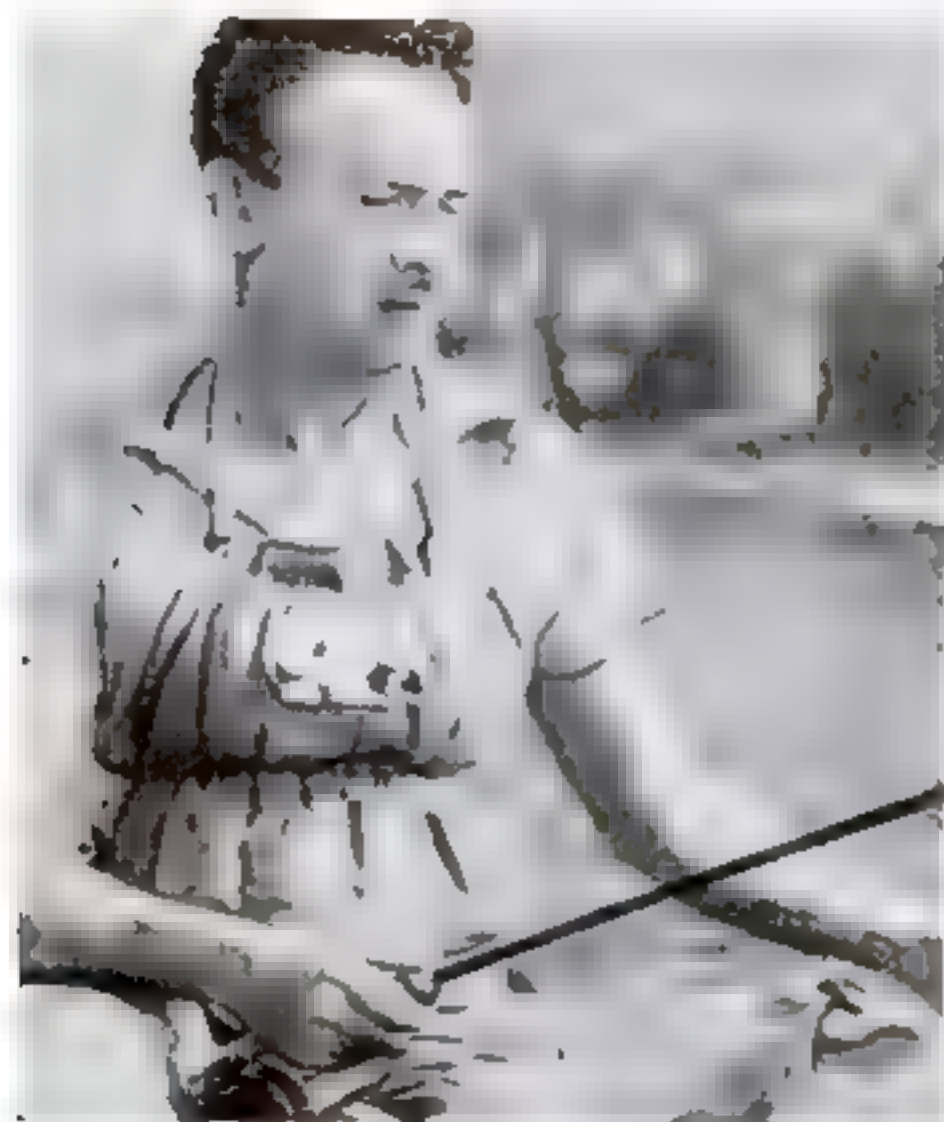


The lower, wavy line was traced by a lamp on a hub, as at left; the upper, almost-straight line by one on the car's top



TO DEMONSTRATE graphically how the spring system of an automobile absorbs road shocks, test engineers recently took the novel photograph shown above. On a dark night, with an electric lamp on the roof and another on a wheel hub, a car was driven over a rough road while a

camera was trained on it with the shutter open. The lower line thus shows how the wheel bobbed up and down, while the comparatively even course of the upper line indicates how the car springs absorbed the road shocks before they reached the body of the automobile



ANGLER'S "APRON" HOLDS FLY-FISHING EQUIPMENT

SUSPENDED from the neck like an apron, a new fishing kit is a handy accessory for fly-rod anglers. Made of lightweight khaki for summer wear, the unit allows free arm movement at all times. The kit has pockets for fly box and tackle, and a strip of sheep's wool for drying artificial bait. When not in use, it folds to fit in the tackle box.

EYE TEST REVEALS VITAMIN NEED

LACK of vitamin A among Altoona, Pa., school children is detected with the aid of a novel eye-testing instrument known as a "biophotometer." The apparatus measures a substance in the human eye called "visual purple," which is destroyed by exposure to light but is constantly recreated from the vitamin A in the system. When a pupil peers into the device, as shown in the photograph at the right, the apparatus indicates the rate at which "visual purple" is regenerated, to show whether the child is lacking the normal amount of vitamin A. Other tests reveal deficiencies in vitamin C, blood iron, and other nutritional factors, to guide the school authorities in recommending changes in diet.

A pupil looking into the "biophotometer," which gauges the amount of vitamin A in the body



PORTABLE LABORATORY AIDS GARDENER



Trays are mounted on a spike that is stuck into the ground

TO AID him in his work of breeding rare daffodils, Kenyon L. Reynolds, Pasadena, Calif., horticulturist, uses the novel portable plant laboratory pictured at the left. Mounted around a pointed metal shaft, which can be pushed firmly into the ground, are circular trays that carry small boxes for plant pollen. At the top of the shaft a rectangular tray provides space for reference books and for a stack of memorandum cards

FACTORY CHIMNEYS MAY YIELD DRY ICE

EXPERIMENTS at Columbia University in New York City have shown the feasibility of manufacturing solid carbon dioxide, or dry ice, by reclaiming exhaust gases from chimneys of large power plants and factories. A chemical "scrubber," built into the smokestack, removes the carbon dioxide gas from the flue vapors and stores it for later solidification into dry ice.

TOBACCO PIPE IS MADE OF COLORED GLASS



Unique pipe made for a tobacconist's window

MORE than 100 years old, the novel pipe shown in the photograph is made entirely of red and white glass. The transparent pipe, a feature exhibit at a recent exposition held in New York City, measures almost three feet in length and was originally made for display in the show window of a tobacconist's shop.

Cowboys of the Sea

DRIVE CATTLE TO OCEAN ROUND-UP



A steer from the vast Parker cattle ranch on the island of Hawaii being led into the water for ferrying to the steamer that will take it to market



Following a guide line, the cowboy drags the steer to a waiting lifeboat and tosses the lasso to the crew. The animal is tied fast with its horns against the gunwale. With six steers secured, the boat is towed to the steamer

DRIVEN by seagoing cowboys riding specially trained horses, 12,000 steers and 4,000 sheep are herded into the Pacific from little-known ports in the Hawaiian Islands every year for delivery by cattle boat to Honolulu. This novel system has been functioning for 100 years, and for the first time a representative of POPULAR SCIENCE MONTHLY recently obtained photographs of scenes which, until now, have been witnessed only by employees of the ranch and of the transportation company that handles the cattle.

At Kaalualu, a volcanic promontory on the southern tip of the island of Hawaii, so far off steamer lanes that the cattle boat *Humuhumu* calls only four times a year, cattle slide down



By JOHN E. LODGE

chutes on their haunches into the sea. At Kailua and Kawaihae, on the west coast, native cowboys round up the cattle and lead them through the surf to waiting lifeboats for delivery to the cattle ship.

Most of the steers come from the famous Parker ranch, one of the largest in United States territory. Covering 1,200,000 acres, it stretches far up the slopes of Mauna Loa, 13,675 feet high. Its beef supplies the inhabitants of the islands of Molokai, Maui, Hawaii, Lanai, Kauai, and Oahu.

Drives which deliver the cattle through the breakers continue throughout the year. Herds are moved forty miles from the high lands through successive grazing areas, until the cattle consume their last green feed some ten miles from the sea. On the final night, they are driven into corrals built of lava rock and wood on small promontories and on sandy beaches.

Since the shipping points are located on the lee side of the island, where reefs forbid the entrance of ships of even shallow draft, means must be provided for "ferrying" the cattle a quarter of a mile out to sea.

Consider the picture at Kaalualu. At sunup, the *Humuula* stands offshore, a power launch chugging through the breakers toward the land. Near the cattle chute, a lifeboat rides the swells



"Shipping day" at Kaalualu, where the cattle slide on their haunches down chutes into the sea. A steer is just striking water near the boat.

Right, future beefsteak hesitating before "walking the plank." A gentle shove from behind will help him make up his mind. Note the tow line held by the boat's crew.



A passenger coming aboard the *Humuula* for the trip to Honolulu. Belly bands are slipped under the steers in the water, and they are lifted into pens on the deck.

with four native crew members quietly awaiting their first "cargo."

Ashore, cowboys drive Hereford steers from the round-up corral into a long, boarded chute. As the cattle approach the exit, six-foot ropes are slipped over their heads. Near the chute, small lines leading to the waiting boat are tied to the ropes.

At last, with a shout, ranch workers give a luckless steer a gentle shove, and down the animal goes, sliding on his haunches into the sea. He disappears in a smother of foam, and as his head comes up eager hands on the tow line haul him quickly to the side of the boat. There the steer is tied firmly with its horns against the gunwale, ready for the ride to the ship.

At Kawaihae and Kailua the procedure is somewhat different. There, cowboys drive and lead individual steers through the breakers, swimming them to the waiting lifeboats. At these places the cattle are cut out from the herds in holding corrals in groups of six, and turned into roping corrals which lead directly to the sea. One cowboy then ropes a steer and runs the animal into the breakers.

The cowboy follows a guide rope connecting boat and shore, which prevents the animal from turning toward the shore. As he nears *(Continued on page 115)*

The Mud House

Comes Back.

*New Weatherproofing
Process Revives Ancient
Building Art*



This modern home was built of adobe, treated to withstand moisture, and then covered with stucco

THROUGH the discovery at Leland Stanford University, Calif., of a new weatherproofing compound, the ancient building material of the Southwest, adobe, is coming back into favor. Applied to adobe bricks, the chemical solution protects them against decay and makes the material suitable for use in any climate.

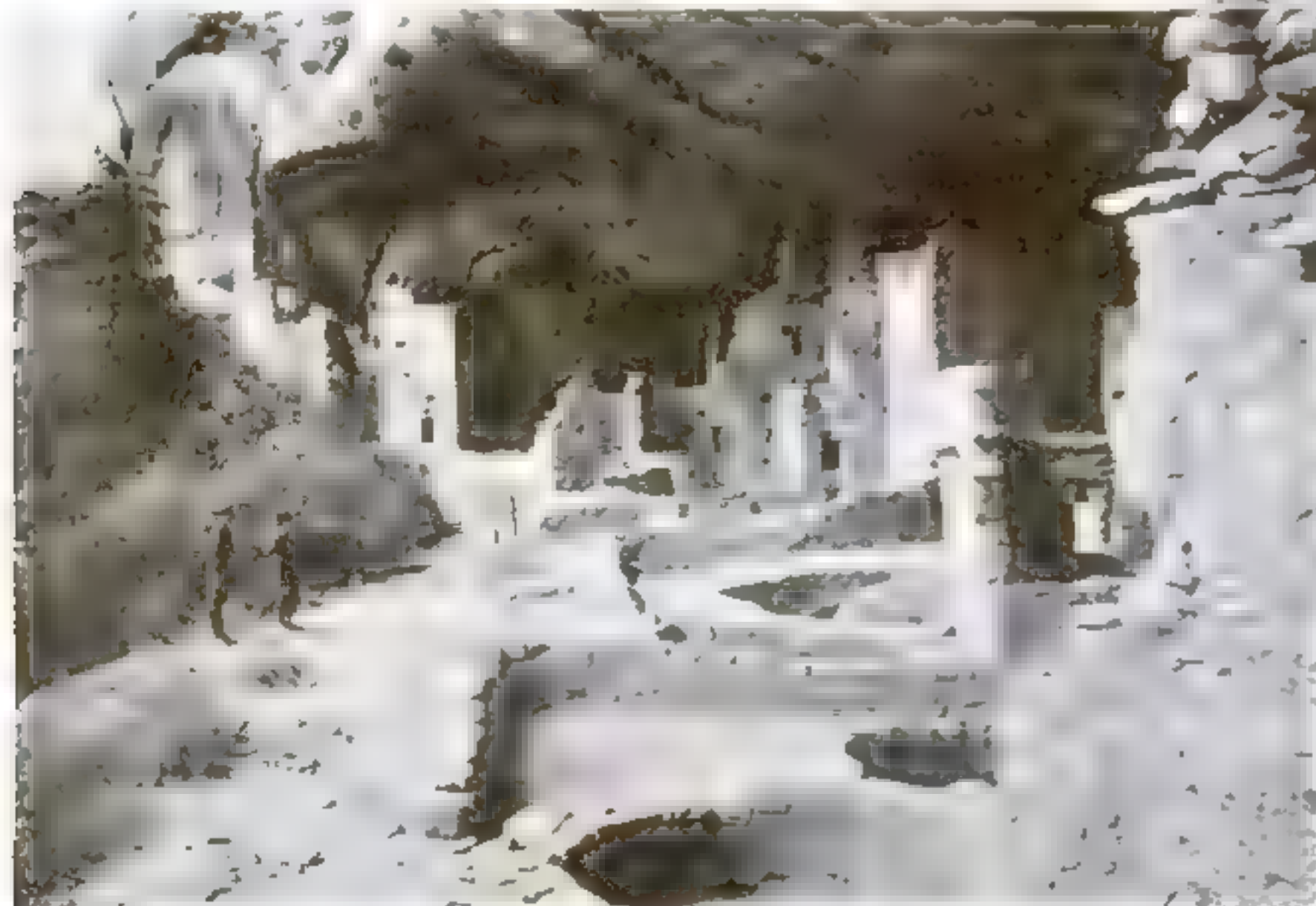
Although developed principally as a means of preserving the ancient adobe ruins in the national parks of the Southwest, the amazing compound is now finding widespread use in the construction of new buildings. As this is written, more than 180 "mud houses" are being constructed by one branch of the Government alone, the Resettlement Administration, and each is being weatherproofed with the new mixture.

Three years of laboratory and field work preceded the discovery of the compound by Frederick T. Martius of the U. S. National Park Service. The mixture he evolved, consisting of vinyl resin, acetone, and toluene, is insoluble in water, will not peel, and does not change the original color of the adobe.

Throughout the Southwest, adobe buildings have long sheltered both white and red men. The mud of which they are made is formed of a combination of eroded volcanic rock and lime from the shells of sea animals. Mixed with straw and weeds, and dried in the sun, it produces bricks of unusual lasting qualities, particularly in warm, dry climates. Now, through the discovery of Martius' compound, the mud house will be durable under any weather conditions



Packing the mixture of adobe clay into wooden brick forms



A builder laying mud bricks to form the walls of a house. More of the bricks are piled in the foreground

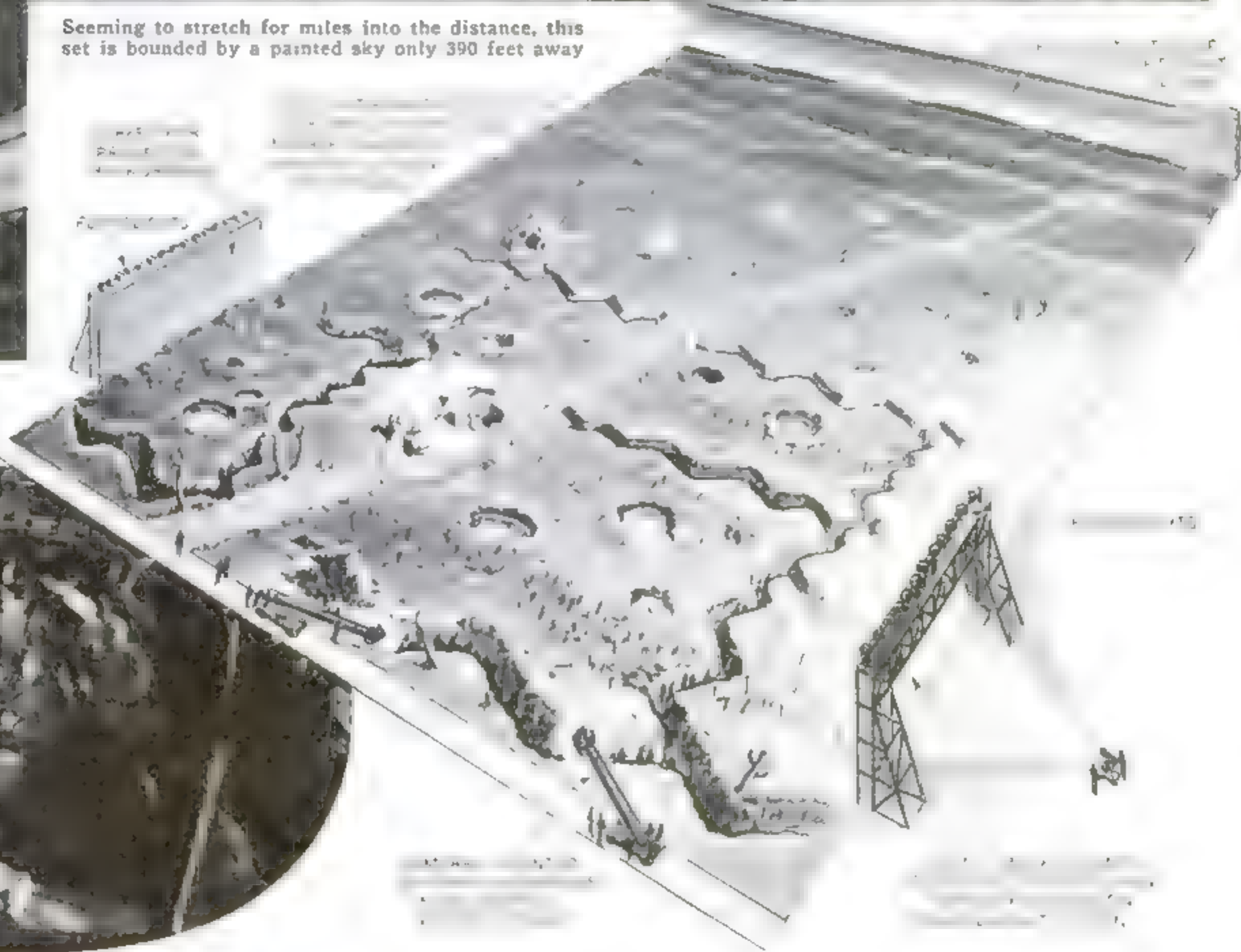
Cliff-dweller ruins in Mesa Verde National Park. The new process for weatherproofing adobe was first used for preserving such historic walls



Seeming to stretch for miles into the distance, this set is bounded by a painted sky only 390 feet away



Cameramen perched on the traveling cranes. Below, a close-up in the trenches



Battlefield in Miniature

USED FOR FILMING VAST WAR SCENES

THROUGH the magic of artificial perspective, and a cleverly painted sky supported on concrete pillars, construction wizards recently built in Hollywood a movie battlefield that is no larger than three city blocks but, to the camera eye, seems to stretch on indefinitely to the horizon. Within this unusual set, built for the production "The Road Back," movie soldiers surged out of trenches onto "no man's land" while grinding cameras mounted on booms rolled along wooden tracks across one end of the baby battlefield. To heighten the illusion of depth, objects on the field were made smaller as their distance from the camera increased; trees in the background 300 feet away were only one foot tall. All scenes were filmed at night, and huge batteries of incandescent lamps poured beams of light across the set onto patches of "snow" made by spraying white paint on the earth and on the wooden structure of the trenches. Smoke pots created layers of haze to represent ground fog, and black powder mixed with hot charcoal burst out of buried garbage cans to simulate exploding shells.

Workmen carrying smoke pots through trenches to create the illusion of haze and ground fog



In the photograph below, John F. Selle, a pioneer Spanish-moss ginner, is holding in his right hand some of the green moss, and in his left, the cured fiber



Hair *from* Trees

... **SPANISH MOSS IS NEW UPHOLSTERING MATERIAL**

HAIR from trees! That is the odd product of a flourishing young industry in the South. Nearly seventy small factories, scattered through Louisiana and Florida, are ginning Spanish moss to obtain its wiry inner fiber. In the last twelve months, more than 20,000,000 pounds of this vegetable hair went into the upholstered seats of streamline trains, transcontinental busses, airplanes, yachts, and de luxe trailers, as well as into mattresses and household furniture.

Yet, so little known is this expanding

million-dollar business that a leading economist not long ago listed among the unsolved problems of industry the finding of some use for Spanish moss!

So far, this vegetable gold mine barely has been touched. In picturesque, silver-gray festoons, billions of tons of moss hang from cypress and live-oak trees. The odd plant is a native of the Gulf States from Texas to Florida and extends south as far as Brazil. However, in only two states, Louisiana and Florida, is it abundant enough to make picking profitable. The demand for cured moss, one New

York dealer told me, is almost three times as great as the supply. Since 1933, the price of the finished product has jumped from four cents to ten cents a pound, an advance of 150 percent.

Paradoxically, Spanish moss is neither Spanish nor moss. It is an American air plant belonging to the same botanical order as the orchid, the pickerel weed, and the pineapple. It is not a parasite. It does not injure the tree to which it clings. It obtains both food and water from the air. Yet, curiously enough, if the tree dies, the moss dies also.



A curing yard in which the green moss is spread out to dry. As the outer coating rots, tannic acid forms and cures the inner core

*How a Picturesque Tree Plant of the South,
Long Believed To Be of No Practical Value,
Has Found Many Important Commercial Uses
And Given Birth to a Thriving New Industry*

By ROBERT E. MARTIN

The plant flourishes best on cypress trees in the Mississippi Delta region of Louisiana. In some instances, as much as two tons of moss have been picked from a single tree without noticeably altering its appearance. Sometimes, these threadlike stems attain a length of twenty feet.

In May and June, they bear tiny, yellow-petaled flowers, so inconspicuous that few people notice them. The seed matures slowly, and it is the following March before it floats through the air supported by silken hairs. Fragments of the festoons are carried from tree to tree by gales and by birds, thus aiding the spread of the moss through a forest.

An analysis of the air plant shows that it contains about forty percent fiber, traces of sugar and starch, and water. It has little food value, although cows will sometimes eat it when it is wet and when pasturage is scarce. Farmers in cotton-raising sections often pull down the moss from trees bordering their fields because boll weevils winter in the festoons. Government investigators, noticing that the greatest damage from weevils occurred in patches surrounded by moss-hung woods, discovered that each ton of moss in the trees sheltered approximately 400 of the destructive insects.

For generations, people in certain sections of the South have been stuffing pillows and mattresses with dried moss in place of feathers or cotton. Only recently, however, have scientific methods placed the vegetable hair on the market. In all except the cheapest and the most expensive furniture, it is finding a place. It is said to be odorless, sanitary, naturally mothproof, and to

have a lasting resiliency which is surpassed only by that of the best grades of horsehair.

A few weeks ago, I visited one of the first moss gins established in Florida. It is located on the outskirts of Gainesville and is operated by John F. Selle, a pioneer in the new industry. Nearly 600 families in the vicinity of Gainesville, he told me, support themselves, in whole or part, by gathering moss.

Virtually all the live, or green, moss that reaches the gin is brought by free-lance pickers who go into the woods or along the streams in wagons or boats. With sticks or rakes they drag down the festoons until they have a load. After a windstorm, they sometimes find tons of moss scattered on the ground, and where trees are being felled they are able to obtain wagon

loads of the clinging strands. In a few instances, "moss rights" have been sold in timber lands.

Most of the Spanish moss comes in during summer months. The price varies from about four dollars a ton, for green material, up to thirty dollars a ton for the cured, black moss. A picker can make two or three dollars a day without great effort. In most cases, whole families go into the woods on "mossing" expeditions.

Once or twice a week, trucks from the factory make runs over regular routes, covering a territory within a radius of fifty miles of Gainesville, to pick up loads of green and dried moss collected by outlying pickers. Near the plant are two curing yards. One is a level field containing eight acres. It will accommodate upwards of 2,000 tons (Continued on page 119)



The new material being used to stuff a chair. In the last year, 20,000,000 pounds of it went into seats, mattresses, and furniture



GINS CLEAN THE FIBER

Below is a ginning plant in which moss is sent through machines like the one at the right for cleaning. Lower right, moss strands



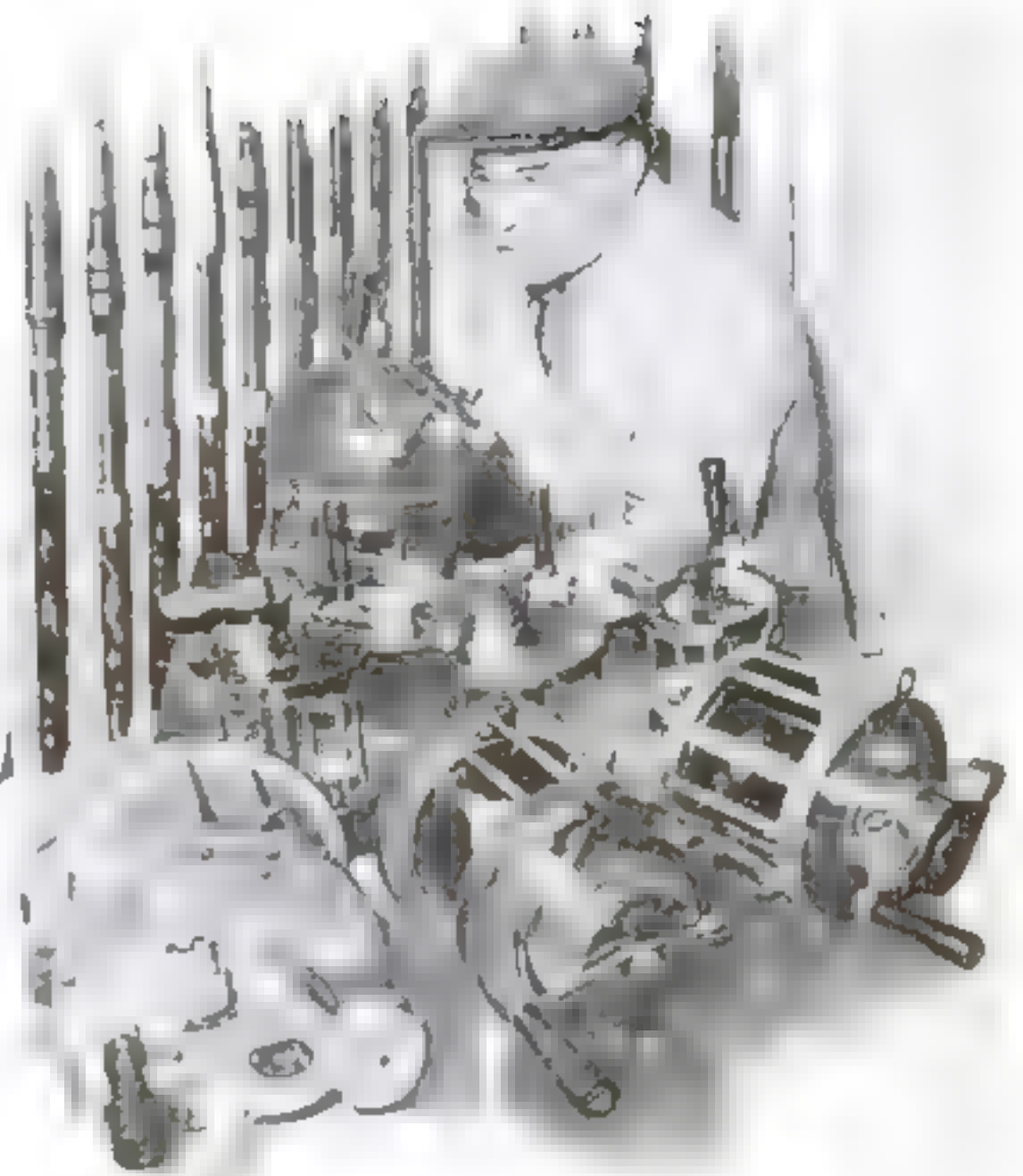
DEVICE RECORDS COURT PROCEEDINGS

RECORDS of law-court proceedings are made automatically by a new mechanical stenographer. With microphones scattered about the courtroom, the device transcribes the remarks of lawyers, judges, and witnesses onto wax disks. To repeat the

spoken words of one of the principals, for use in court or for typing into court records, an operator presses a selected button and the voice is reproduced through an amplifier and loudspeaker unit.



By pressing a selected button, the operator reproduces the words of any one of the speakers



GARGANTUAN REELS BUILT FOR DEEP-SEA FISHING

TO ENABLE sportsmen to catch large ocean fish with a maximum of ease, a California machinist builds giant fishing reels, some of which hold more than a mile of line. Made of stainless steel and guaranteed for life, the mammoth reels, valued at prices up to \$1,000, measure as much as nine inches in diameter.

RADIO TRANSMISSION OF POWER TRIED



Laboratory with odd antenna used in power-transmission tests

Using an odd cage-like antenna and special ultra-short-wave equipment, a New Castle, Del., inventor is now carrying on experiments which he expects will prove the feasibility of transmitting large amounts of electrical power through the air by radio. According to present plans, an attempt will be made shortly to transmit for a distance of 100 miles sufficient power to supply the lighting needs of a large house. Hitherto, radio-power tests have been confined to short distances.

FRESHNESS FROZEN IN FRUIT JUICE

WHEN frozen solid by an automatic machine recently perfected, fruit juices are said to retain their freshness and vitamin content for long periods. The juice is hermetically sealed in cans, which are then passed through low-temperature chambers by the freezing mechanism. In this way, juices can be shipped for long distances.

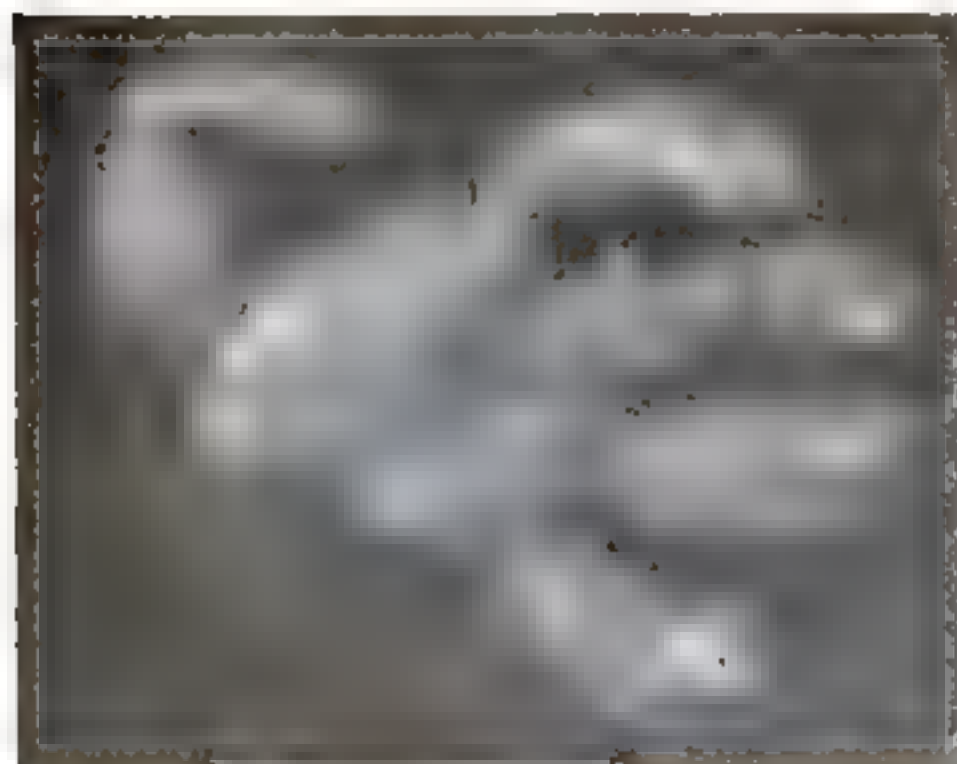


These cans contain fruit juices frozen hard for long-distance shipping

DIAL SELECTS THE SAW FOR ANY GIVEN JOB

A HANDY dial for use in home workshops quickly indicates complete specifications for machine-sawing or filing common materials, forty-eight of which are listed on its revolving rim. Twirled to a specific material, the dial automatically shows the correct saw to use.

FREAK POTATOES FORM SIDE SHOW AT FAIR



GNARLED and twisted into a hundred curious shapes, a collection of potatoes formed an outstanding feature of a recent agricultural exhibition. Included among the many odd freaks of nature displayed in the horticultural side show were the tubers shown in the accompanying photographs. One resembled a misshapen human hand, another looked like a seal, a third like a fantastic imaginary dinosaur, and a fourth had the appearance of a baby alligator.

This potato might easily be mistaken for a baby alligator



A misshapen human hand, a seal, and a prehistoric monster—all exhibits in an odd collection of potatoes that grew in queer shapes



NONSKID WORK GLOVES HAVE RUBBER COATING

TO KEEP them from sliding on smooth surfaces, cotton work gloves of a type just marketed are coated with a thin layer of rubber. When the wearer grips a smooth-handled tool or slippery steering wheel, the rubber coating is said to create a friction that checks slipping. Rubberizing the gloves also makes them waterproof.

MECHANICAL TARGET TRAINS FENCERS

A MECHANICAL fencer invented by Hubert Pirotte, coach at Rutgers University, New Brunswick, N. J., is said to improve the speed, form, and accuracy of swordsmen. Fastened to a wooden target, a foil is held in correct fencing position by metal rings supported by coil springs and a chain. When struck aside, the foil springs back to simulate the defensive action of a human fencer. More than 100 exercises can be used with the device.



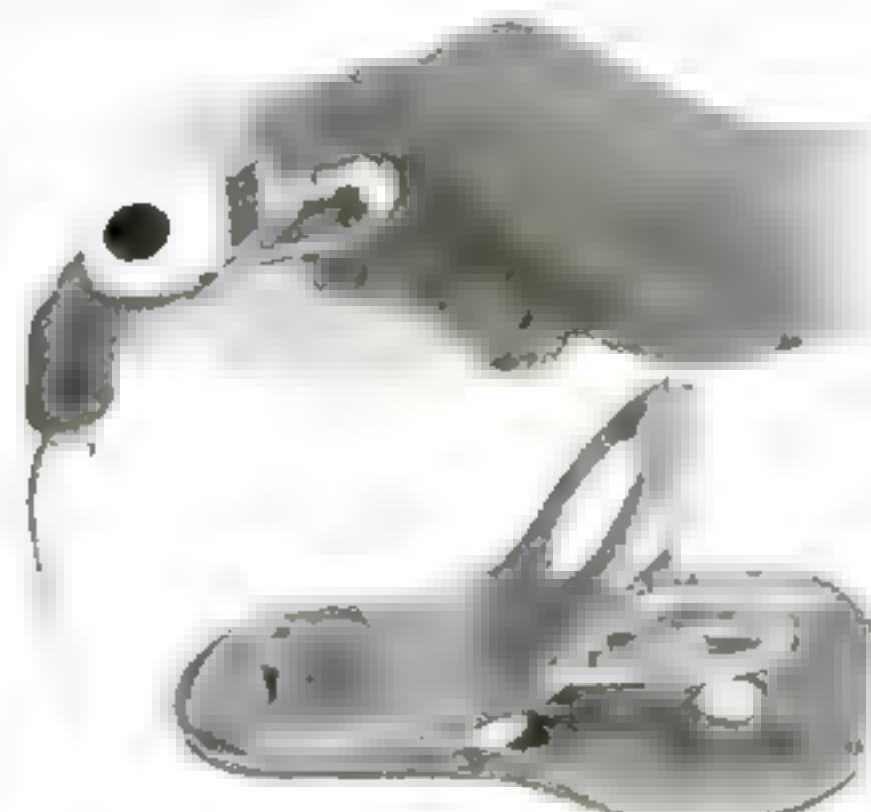
A fencer using the target. A spring-mounted foil parries his thrusts

HUGE TENT SHELTERS TENNIS PLAYERS

THREE THOUSAND yards of canvas, stretched over a tennis court in Seattle, Wash., make it possible to play the game in wet or stormy weather. Erected by two high-school tennis enthusiasts, the tent is suspended on cables attached to eleven telephone poles surrounding the court. Side flaps can be rolled up in good weather, while electric lamps illuminate the court for night playing. The tennis tent is sixty feet wide and more than 100 feet long.



Players in the tennis tent, which permits the court to be used in rainy weather



SAFETY MOUSE TRAP CAN'T CATCH FINGERS

A NEW all-metal mouse trap can be set without danger of catching the fingers. When one end of the trap is pressed down, it snaps in place, leaving a bait trigger exposed in the open jaws formed by the other end. When caught, the mouse is removed as shown above.



REDWOOD TREE YIELDS BIGGEST BOARD

LARGE enough to make a fair-size dance floor, a giant slab of wood hewn from a California redwood tree is said to be the largest board in the world. All in one gigantic piece, the huge plank was milled from a tree cut down in Mendocino

County and estimated by experts to have been more than 1,000 years old. The redwood board is shown in the photograph above with three girls standing before it in order to give a graphic indication of its relative size.

SIGN HALTS MATCHES AT REFINERY GATE

WORKERS at a Texas oil refinery are forcefully reminded to park their matches before entering the plant by the odd sign shown below. Because of the fire hazard, employees deposit their "outlawed" matches in the receptacle provided, replenishing their supply as they leave the grounds after work.



Refinery workers "checking" matches at the gate



Translucent cylinder screwed on a regular flash light for use in signaling at night

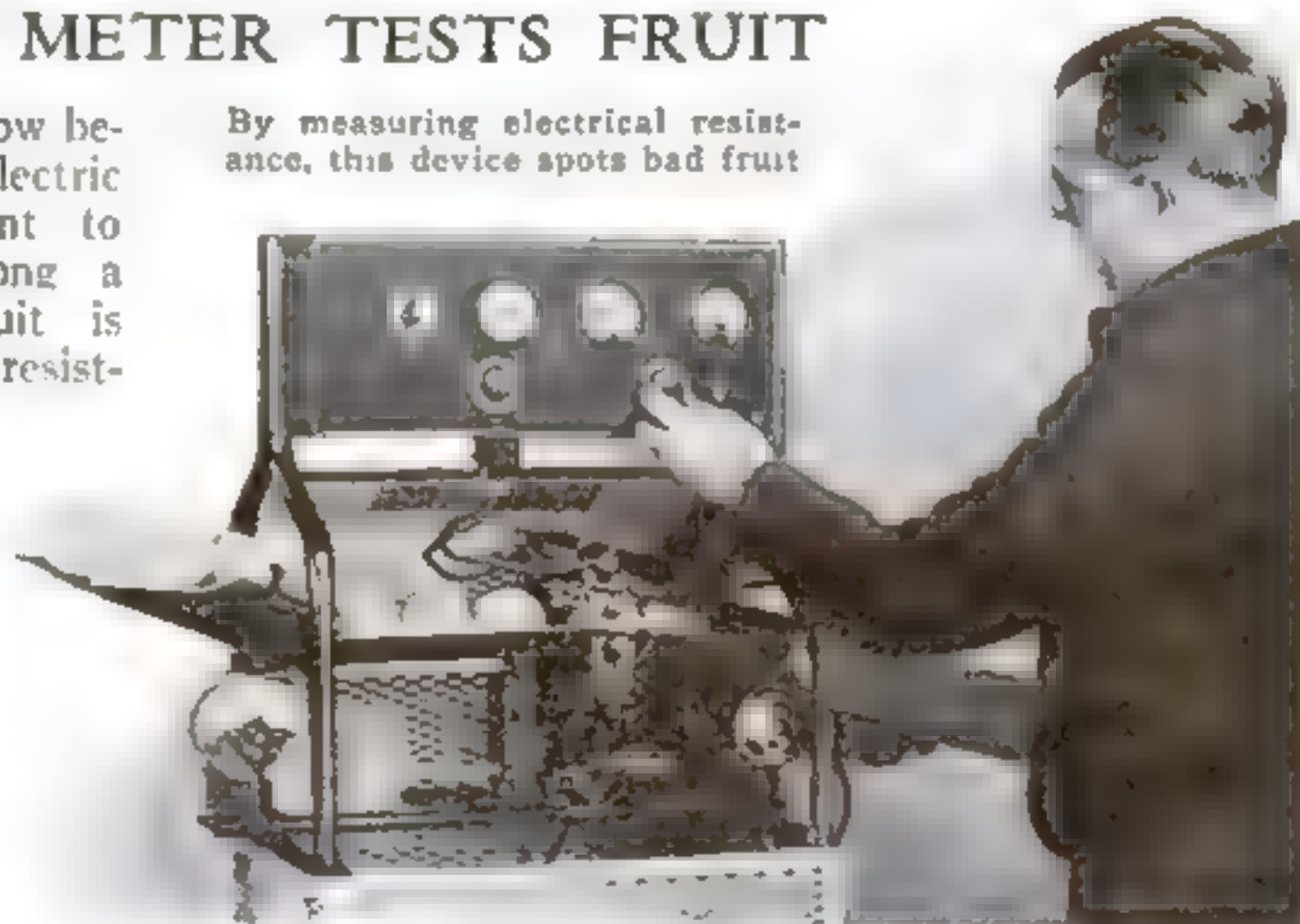
LUMINOUS SIGNAL WAND AIDS TRAFFIC POLICE

POLICE who direct night traffic at unlighted street intersections or along dark highways are aided by a novel flash-light torch recently placed on the market. A hollow cylinder, made of a red-tinted translucent material, is screwed onto the end of a conventional flash light in place of the lens. When the light is snapped on, the torch has a brilliant glow that is said to be visible to motorists at great distances. The regular lens screwed onto the outer end of the cylinder allows the torch to be used as a spotlight like any ordinary flash light.

ELECTRIC METER TESTS FRUIT

CITRUS fruits are now being checked by an electric device before shipment to the market. Fed along a moving belt, the fruit is tested for its electric resistance, which is said to indicate its interior condition. Spoiled or decayed fruit is thus spotted and automatically removed from the line. The ingenious machine is said to check a carload of fruit in a day.

By measuring electrical resistance, this device spots bad fruit



Young trees stored in an ice house to accustom them to cold

COLD TREATMENT TOUGHENS TREES

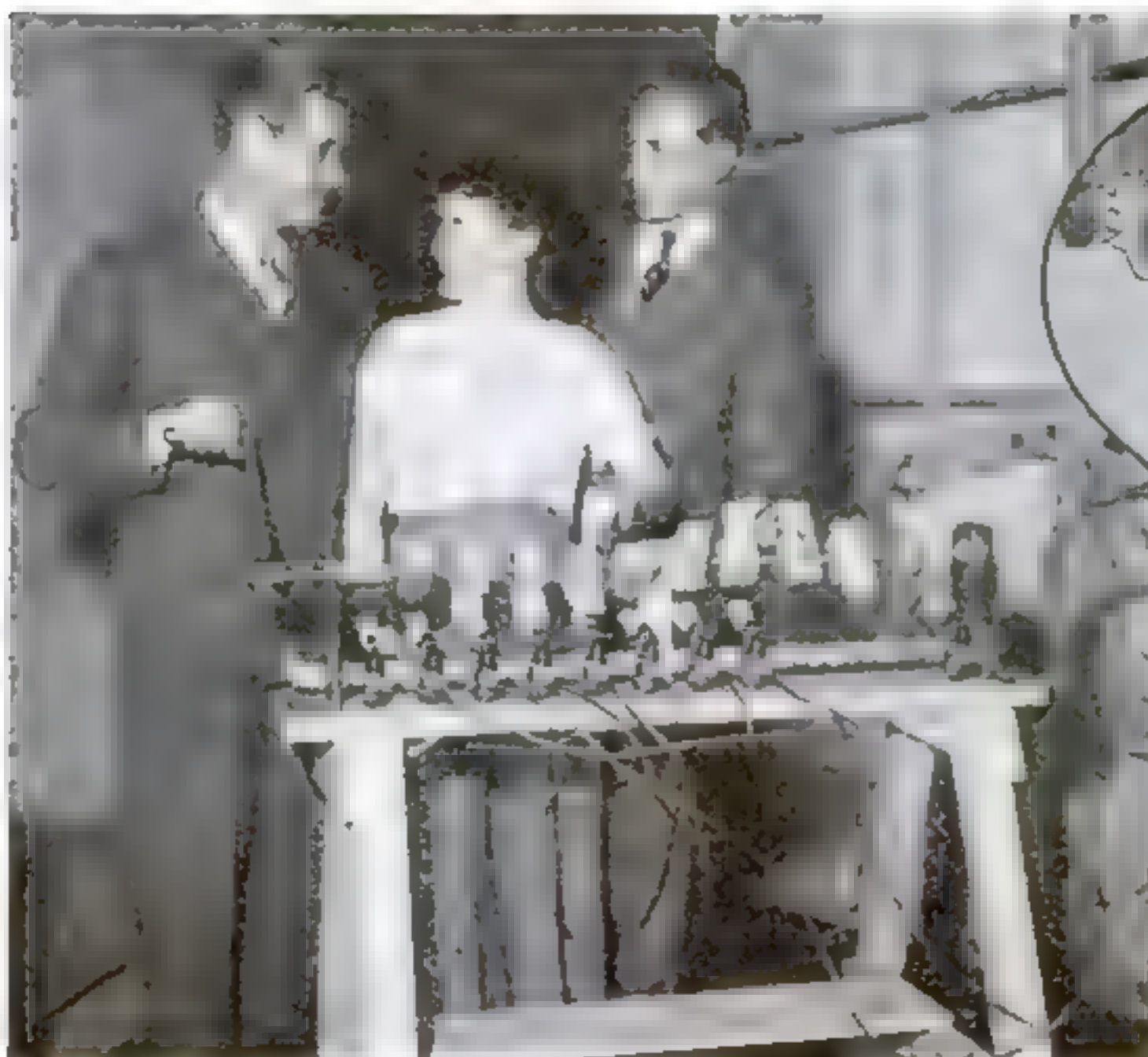
YOUNG trees destined to be planted at high altitudes in mountainous country are now trained to withstand frigid temperatures by a special icing treatment. Before they are set out, the trees are placed in an ice house which is kept at a constant temperature of thirty-two degrees F. and at a relative humidity of eighty-seven. By thus adjusting themselves to the cold, mountainous climate they will soon have to meet, the trees are said to have a much better chance of survival. In the photograph at the left, B. P. Greendyke, California forester, is examining one of a batch of young evergreens that are undergoing the cold treatment.

MACHINE IMITATES GUNFIRE FOR MOVIES

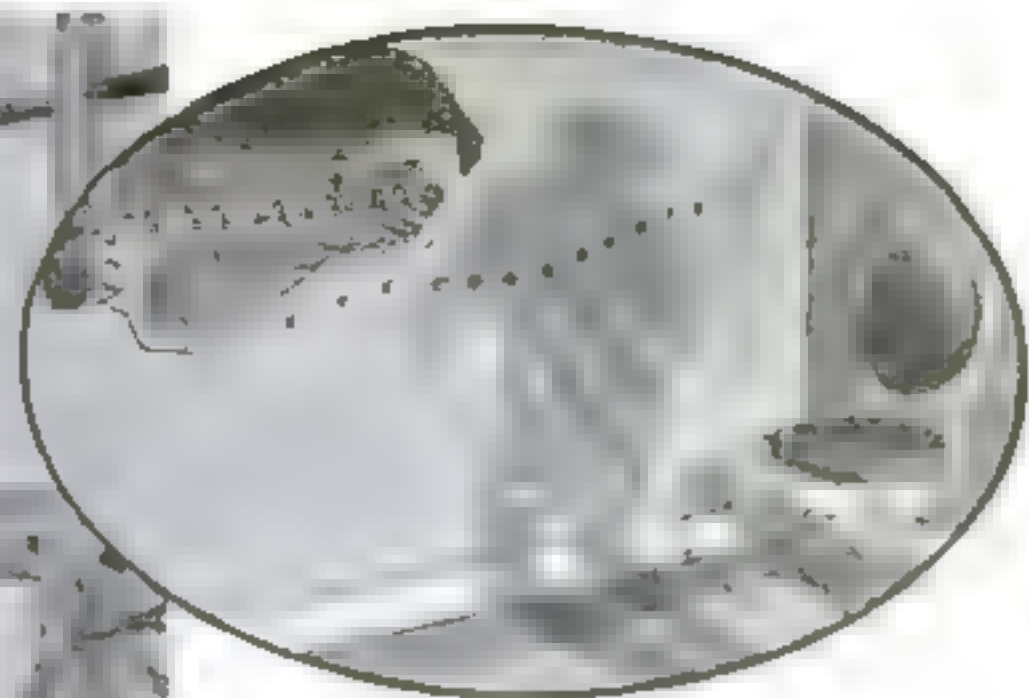


ODD LEGGINGS FOIL INSECTS

DECORATED with fringe, novel mosquito leggings have just been introduced to protect women's legs from insect bites. Slipped over stockings, the transparent leggings, shown above, are made of a mosquitoproof netting in colors to match various stocking shades.



Screen stars examining the "machine-gun" mechanism. How it gives the effect of bullets spattering against a wall is shown above at right



TO SIMULATE machine-gun bullets spattering against a wall in a forthcoming movie, an ingenious apparatus has recently been devised. Set just behind a plaster wall surface, small pneumatic tubes are connected to a trigger mechanism mounted on a revolving arm. When the arm is rotated, valves open to force compressed air through the tubes, thus bursting spots of plaster out of the front surface of the wall.

SHIP RADIO LISTENS FOR DISTRESS CALLS

AN AUTOMATIC radio alarm for ships at sea "stands watch" for emergency calls from other ships whenever the regular operator is off duty. Adjusted to receive signals on or near the international distress wave length of 600 meters, the apparatus reacts to a special code signal consisting of a series of long dashes separated by a one-second interval. It then rings an alarm bell and snaps on warning lights to call the operator back to duty. If anything goes wrong with the mechanism itself, the alarm goes off automatically. The robot receiver was designed especially to insure that distress signals will not be missed by small ships carrying only one radio operator.



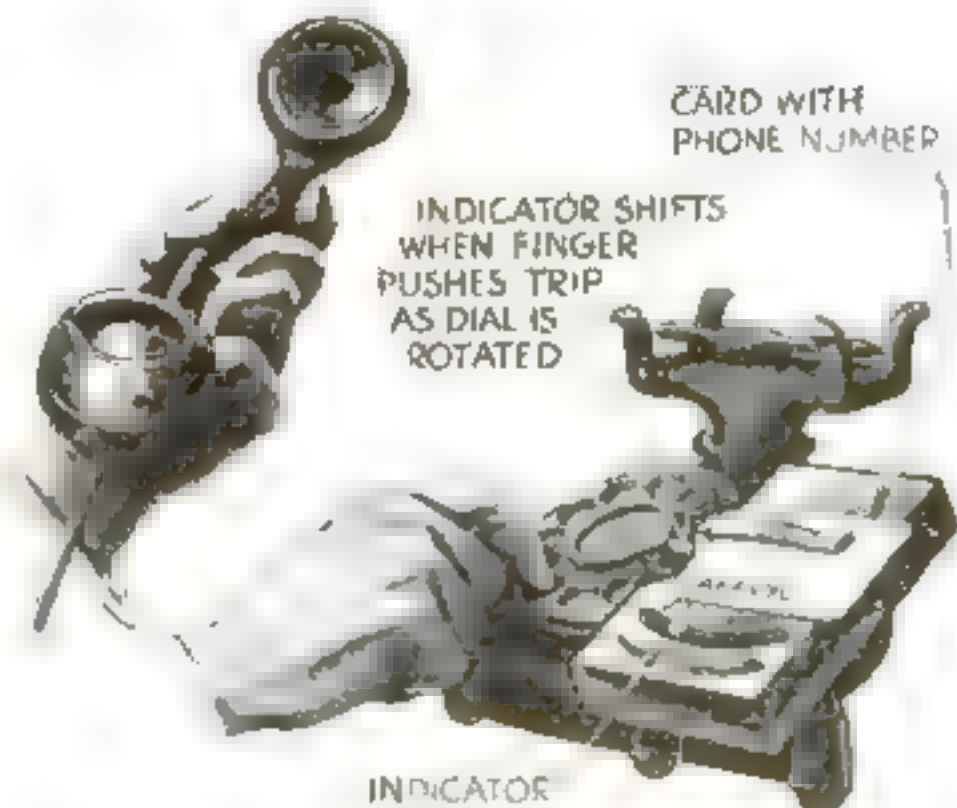
On shipboard, this machine "hears" distress signals and sounds alarm

MECHANICAL BRAIN REMEMBERS IMAGES



Expert adjusting the memnoscope, which memorizes electrical data

POSSESSING some of the qualities of human memory, an electrical machine just perfected by Westinghouse engineers "remembers" and "forgets" electric pulsations. The device picks up current variations, registers them in its "mind," and then recalls and reproduces them on the screen of a cathode-ray tube as a visible fluctuating line. Called a memnoscope, the apparatus was developed to demonstrate the theory that human memory is really an electrical process.



HANDY NUMBER MARKER AIDS IN DIALING PHONE

DIALING a telephone is made easier by a handy indicator just invented. Attached to the side of the phone, the device has a pointer which moves to each succeeding letter or numeral after the previous one has been dialed, thus avoiding dialing confusion and preventing wrong numbers.



A "phantom pencil" is seen behind two pencils held as shown

Don't Believe Your Eyes!

This Article Describes Some Common Optical Illusions—Tricks by Which Your Seeing Apparatus Often Is Fooled

By ALDEN P. ARMAGNAC

SIDE BY SIDE, on the desk of the manufacturer of a nationally known brand of fish cakes, stood two cans. Each held exactly ten ounces. One was tall, the other flat. Which style should the executive choose for marketing his product?

"My eyes must be playing tricks on me," he mused, as he fingered and studied the cans, "for that flat one looks bigger." He pressed a buzzer, gave orders. Assistants set sample cans before one employee after another, and jotted down the impressions of stenographers, machine operators, and shipping-room clerks. The vast majority confirmed the executive's judgment.

Therefore, although tall cans could be used more cheaply, the flat tin is the one that purchasers of this brand of fish cakes bear home from grocery stores today. Thrifty, bargain-hunting housewives must

be catered to, and they want the tin that looks the biggest—even if that impression is the result of an optical illusion!

Can you believe your own eyes? Don't be too sure of what they tell you, scientists say. Your seeing apparatus can be fooled in dozens of ways. Some of its mistakes will amuse you; some can be put to good practical use; and still others may be actually dangerous, unless you are forewarned against them.

Looking one day at a pattern for a piece of printed dress goods, a German physicist, Johann Zollner, accidentally discovered a curious optical illusion. Zigzag cross lines made parallel lines

in the pattern look bent out of shape. Psychologists have come upon a whole series of similar effects, in which innocent-looking additions distort straight lines and perfect circles. The illusions exist not only in designs on paper, but in actual objects that you may see about you.

Beware if you are tracing a pipe, for example, that slants downward into a solid wall. It will emerge on the other side, not where you expect, but at a point several inches lower. This strange behavior of slanting lines, known after its discoverer as "Poggendorf's illusion," is one worth knowing.

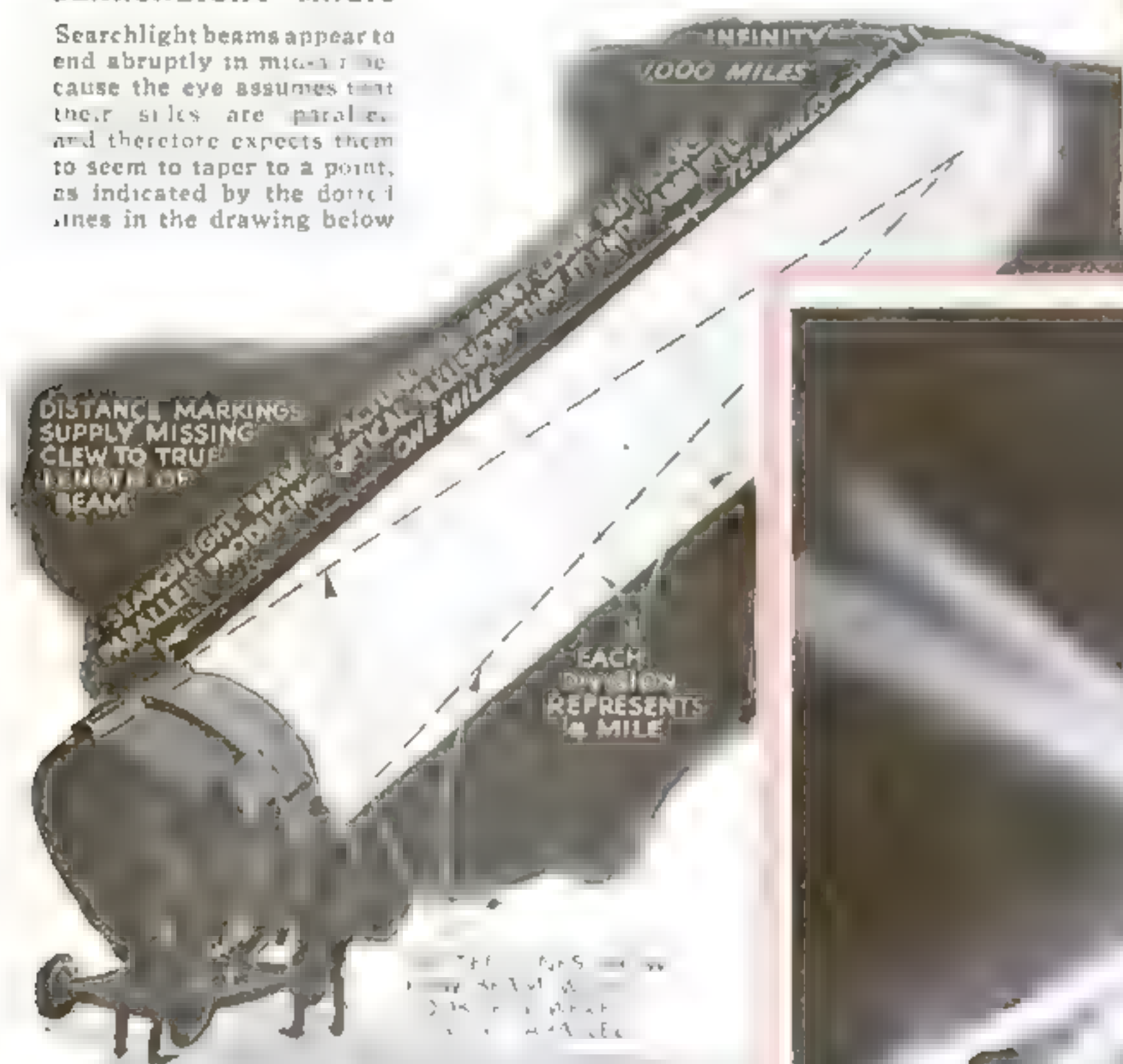
If architects were less familiar with optical illusions, many of our fin-

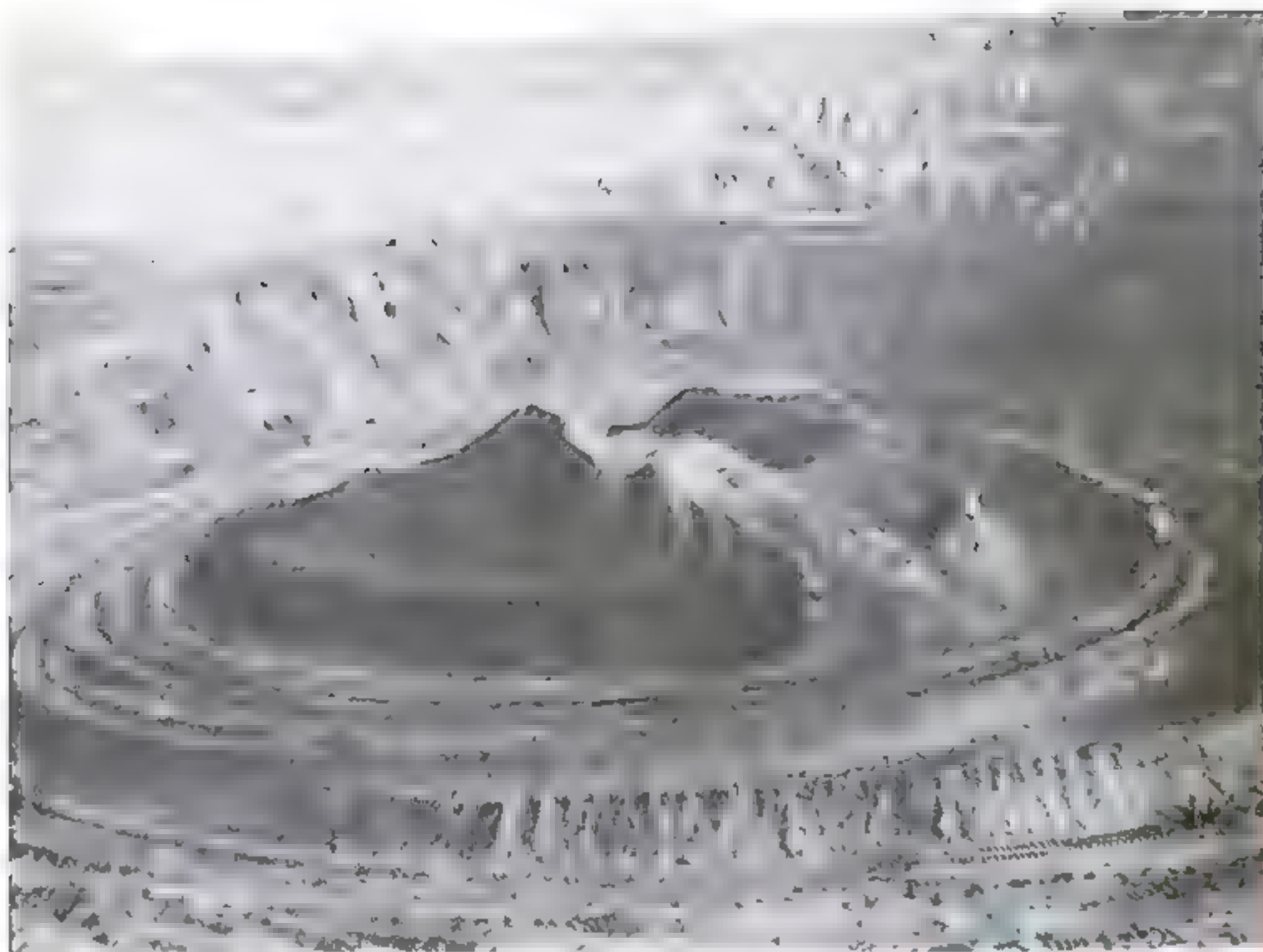


Stare for a minute at the picture at the left, and then shift your gaze to a blank space. You will see an "afterimage" with light and dark portions reversed

SEARCHLIGHT MAGIC

Searchlight beams appear to end abruptly in mid-air, because the eye assumes that their sides are parallel, and therefore expects them to seem to taper to a point, as indicated by the dotted lines in the drawing below.





Turn this photograph upside down, and you will see ridges apparently turning into hollows, and hollows into ridges. This is due to the way we have learned to judge objects by shadows

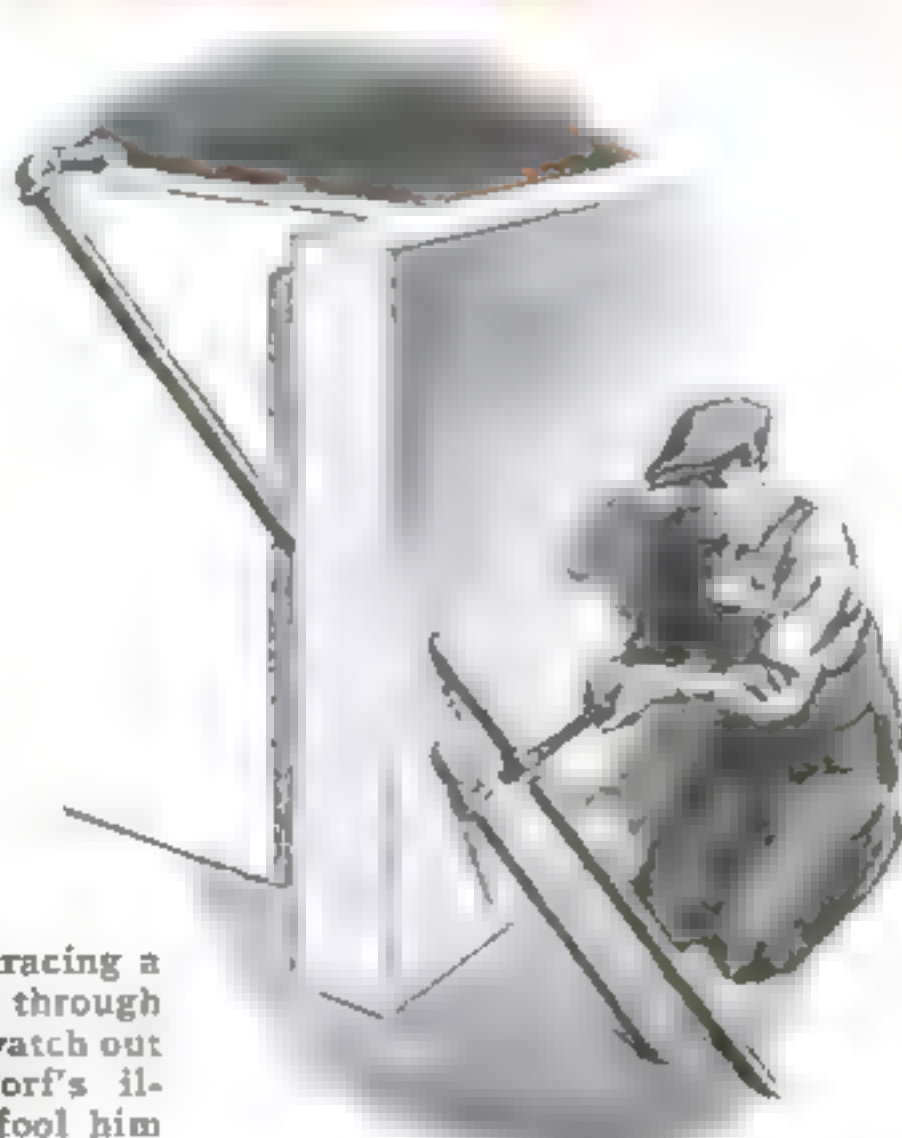
est buildings would appear to be in imminent danger of falling down! Great architectural pillars of stone, when made with straight sides, look pinched-in at the middle and incapable of supporting the massive loads they must bear. To make them look right, the columns are given a slight bulge. So well known to architects is this correction that a special name for it, "entasis," has become a part of our language. The Greeks applied the scheme more than 2,000 years ago, and the famous Parthenon that they built at Athens is considered one of the world's finest examples of its successful use. The sides of this temple's pillars, thirty-four feet high, curve outward as much as three-fourths of an inch from true straightness in order to look straight.

The shape of a package may make it look small or large, as the maker of fish cakes discovered. So may its color. A New York University experimenter dressed food cartons of identical size and shape in plain paper of six different colors, as well as black and white. He asked 168 men and women to pick the carton that looked the biggest. The yellow one drew the most votes; then came the white, orange, green, red, purple, blue, and black, in the order named.

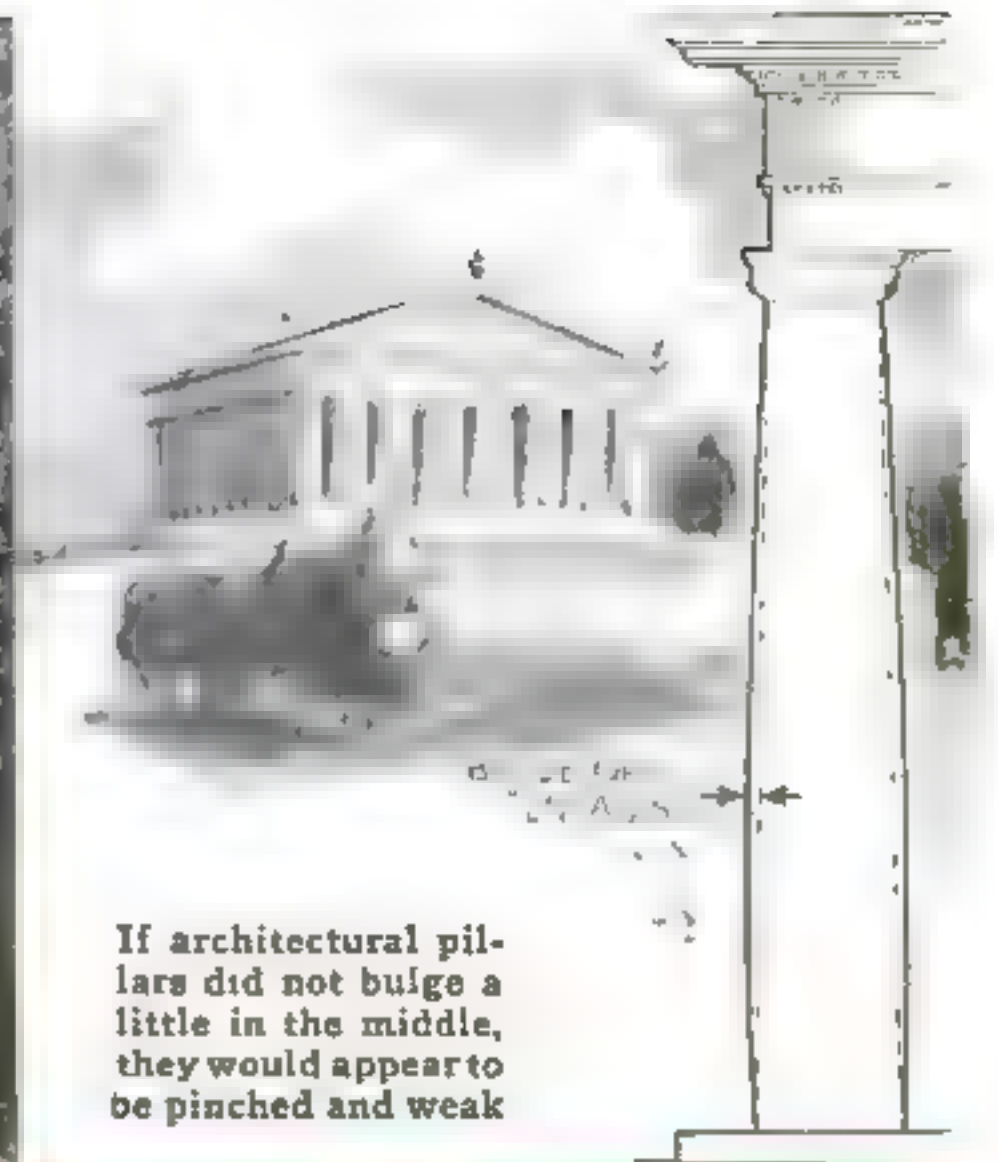
Shadows, too, can produce optical illusions, as Prof. A. C. Hardy of the Massachusetts Institute of Technology points out. Look at an oblique air photo of mountains or valleys, held upside down. Ridges turn into hollows, and hollows into ridges, because of the way we have learned to associate the shadows we see with the actual form of objects.

Stare awhile at brilliantly lighted stained-glass windows in a church. Then shift your eyes to a blank spot on a wall, and you will see one of the most beautiful of a class of optical illusions known as "afterimages." The pattern of the window appears in full detail upon the

Look intently at the flower picture below, and then look away. You will see an "afterimage" of the flower, in complementary, or opposite, hues



A mechanic tracing a pipe slanting through a wall must watch out or "Poggendorf's illusion" will fool him



If architectural pillars did not bulge a little in the middle, they would appear to be pinched and weak



Which can would you say held more? They actually have the same volume, but a thrifty housewife would pick the flat one

blank surface and will persist for several seconds or minutes before fading away. Strange to say, the hues you see in the "afterimage" of the window will be complementary colors, or opposites, of the original ones. Thus a red object gives a green afterimage, and a green object a red afterimage. Blue and yellow likewise change places in an afterimage, as do black and white.

When you stop your car after a long drive, don't be alarmed if you see the road, the trees, and the houses backing away from you. What you are seeing is a particularly vivid kind of optical illusion produced by looking for some time at moving objects. It is an "afterimage" of motion that lasts for a number of seconds, giving you much the same sensation as if you saw a motion-picture film suddenly reversed and run through the projector the wrong way.

If you have been watching the receding landscape from the rear platform of a fast train, and the train comes to a standstill at a station, you will experience the feeling that the scenery is advancing toward you. The same illusion may plague a mechanic who is intently watching a slowly advancing or revolving machine part. Suppose that he tries to stop it just short of a desired point, before making a final hairbreadth adjustment. When he interrupts its motion, the part appears to back or turn away. He must be careful not to try to compensate for this, but wait for the illusion to disappear before making the final setting.

By revolving disks and endless belts in front of subjects' eyes, a British research worker, (*Continued on page 116*)

Has the TRAILER Come To Stay?

TWENTY-FIVE trailers an hour were crossing the state line into Florida on the day we headed north. Hundreds of others were converging on the peninsula along roads that spread away like the ribs of a giant fan. The southward trek of the rolling homes was in full swing.

As related in previous installments of this series, my wife and I were making a 4,700-mile trailer trip through the South. For more than a month we had been gathering first-hand information on life in a "house on wheels."

Day by day, the number of trailers we met had increased. Even in the Everglades, where we ran for hours down a straight, black road with nothing but wav-

ing saw grass stretching away on either side, we encountered trailer after trailer. Even when we rolled out on the silver-gray sand of Daytona Beach for a try at the famous speedway where Sir Malcolm Campbell had rocketed past the wind-swept dunes at 276 miles an hour, there was a trailer ahead of us.

By the time we reached St. Augustine, trailers were rolling through the ancient city gate, clustering around Fort Marion, parking near the "Fountain of Youth," and winding in and out of the traffic sweeping steadily southward. It was here that I had my adventure with the narrow streets of America's oldest city.

For more than 300 years, a house built of sea-shell material called "coquina" has been standing in St. Augustine. It is the oldest house in the United States. Why not get a snapshot of the newest in American dwellings, a trailer, passing the oldest, the St. Augustine house?

While my wife waited beside the house with the camera, I drove around the block. At least, that is what I started out to do. At each turn, however, a "one-way" sign, or a street too narrow to enter, shifted me in a new direction. Soon, I was winding through a maze of the narrowest thoroughfares on the North American continent. People popped out on balconies to watch me pass, pickaninnies swarmed from alleys, motorists ahead backed hastily into side streets like alarmed crayfish, women shouted and motioned to neighbors. Finally, with a queue of youngsters trailing

Trailerites calling for their mail at the post-office window in the mammoth Sarasota, Fla., camp



A pause for lunch by the side of the road in south Georgia



Concluding His Story of a Five-Weeks Trip in a "Rolling Home," the Author Sums Up His Reactions to Trailer Life and His Ideas on Its Future Importance

By

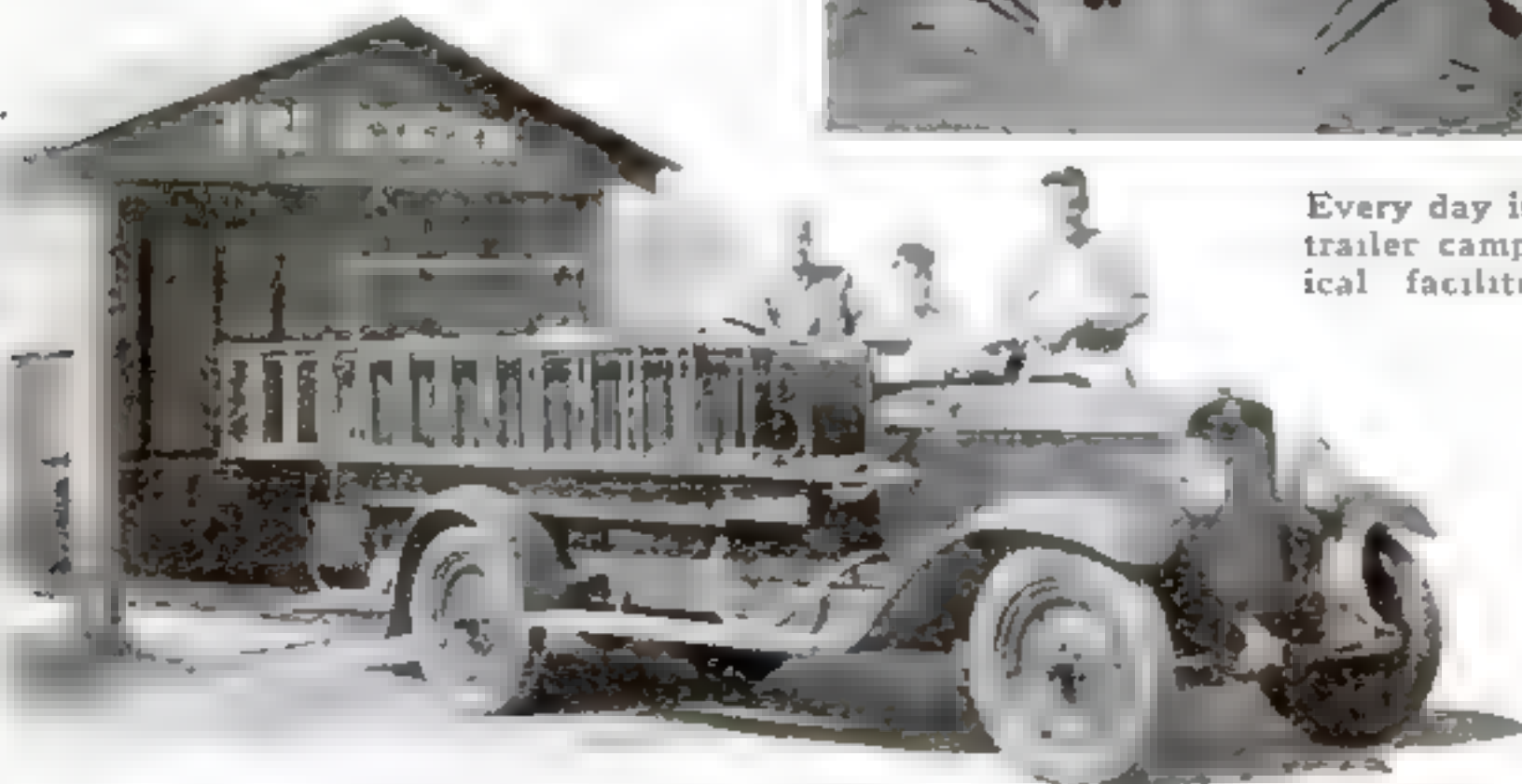
EDWIN TEALE

behind, I came to what seemed to be the neck of the bottle.

A vegetable cart stood at one side of the street, while a sedan was parked a few yards beyond on the other side. Between was a narrow space through which I had to squeeze. A crowd was collecting. Half a dozen people appointed themselves traffic cops. Some motioned for me to come ahead; some held up their hands for me to stop; some waved for me to swing to this side or that. In the end, I disregarded all signals and inched ahead, with ears cocked for a crash, a rip, or a crunch behind. There appeared to be some disappointment in the crowd when the trailer slid through without a scratch and we rolled on down the street. A block beyond, I found an avenue I recognized and swung back to the oldest house by a different route. In spite of the holiday I had provided for the onlookers, the trailer was safe and the picture was snapped.

That night, we camped just over the Florida line in Georgia. A high wind roared through the trees and shook the trailer from side to side. I remembered a hair-raising adventure related to me by a man I had met in a little camp at Tarpon Springs. In another part of the state, his outfit had been hit by the tail end of a hurricane. For hours, he struggled with ropes and stakes to hold the trailer down. At the height of the gale, three trees crashed around him. But when calm returned, the trailer still was upright on its wheels.

As a matter of fact, trailers, having most of their weight at the bottom, are unusually stable vehicles. Once, I accidentally ran a wheel up on a concrete cistern top fully



The oldest and newest in American homes—the trailer in front of St. Augustine's oldest structure

a foot high. The trailer swayed far to one side, but showed no disposition to tip over. On another occasion, we ran down a highway with a forty-mile-an-hour wind pounding the trailer broadside. Yet, it held the road like a turtle.

The sturdiness and safety of trailers recently have been increased by several innovations. Steel and laminated-metal bodies, for example, are becoming standard features. During one recent automobile show, a leading manufacturer of trailers distributed blanks on which those interested suggested improvements they would like to see incorporated in the "homes on wheels." The three develop-

ments now most needed on standard models, it seems to me, are: automatic hitches, satisfactory toilets, and bathing facilities.

Coupling with a present-day trailer hitch is a lot like threading a needle you can't see. It takes too much time and skill. In addition, most of these hitches have several vital parts which are removed and replaced when you uncouple and couple the car. If you lose one of these parts on a trailer trip, you are stranded—at least for the time being. Foolproof, compact units which require no great skill to operate are needed.

Beyond the palm-lined road that leads out of Savannah, Ga., we settled down to piling up mileage. On two days in succession, we covered more than 300 miles between dawn and dusk. Once, we met eight trailers in five minutes. We felt like a bird flying the wrong way at migration time.

As we rolled north, new developments in the trailer world were adding interesting items to the news of the day. We heard of a musician who travels about in his trailer giving concerts; of a preacher who holds services in a chapel on wheels; of the proprietor of a racing sheet who publishes it in his trailer home as he follows the horses from track to track. Barn-storming actors, grain harvesters, fruit pickers, and even a journeyman burglar had turned to the trailer. At a number of universities, students were bringing "houses" to school with them and establishing trailer colonies adjoining the campus. Couples were being married in trailers; babies were being born in trailers; a murder had been committed in a trailer. And, in the Southwest, a man who was left stranded with a trailer when his wife

(Continued on page 118)



Every day is somebody's wash day in a trailer camp. This picture shows typical facilities provided for tourists

The trailer city at Sarasota has its own fire department, shown at the left with its special truck

SPORTSMAN SHOOTS OCEAN FISH WITH BOW AND ARROW

SPEARING ocean fish with a bow and arrow, and then bringing them to gaff with rod and reel, is the novel sport practiced by Bennie Sells, Venice, Calif., angler. With a light fishing line tied to a steel-tipped arrow, Sells shoots the fish from the end of a pier or stalks them at sea in a small rowboat. Using a bow having a pull of eighty pounds, the hunter-fisherman has shot and landed more than 200 fish. Some of the trophies hooked and brought to shore in this unique fashion have weighed as much as eighty pounds. His largest catch for one day was eight sunfish, one of them a sixty-two pounder.



Bennie Sells, of Venice, Calif., with the bow he uses in shooting fish. The arrow carries a line attached to an ordinary rod and reel, as illustrated at the left

METAL CURBS ARE SAFER

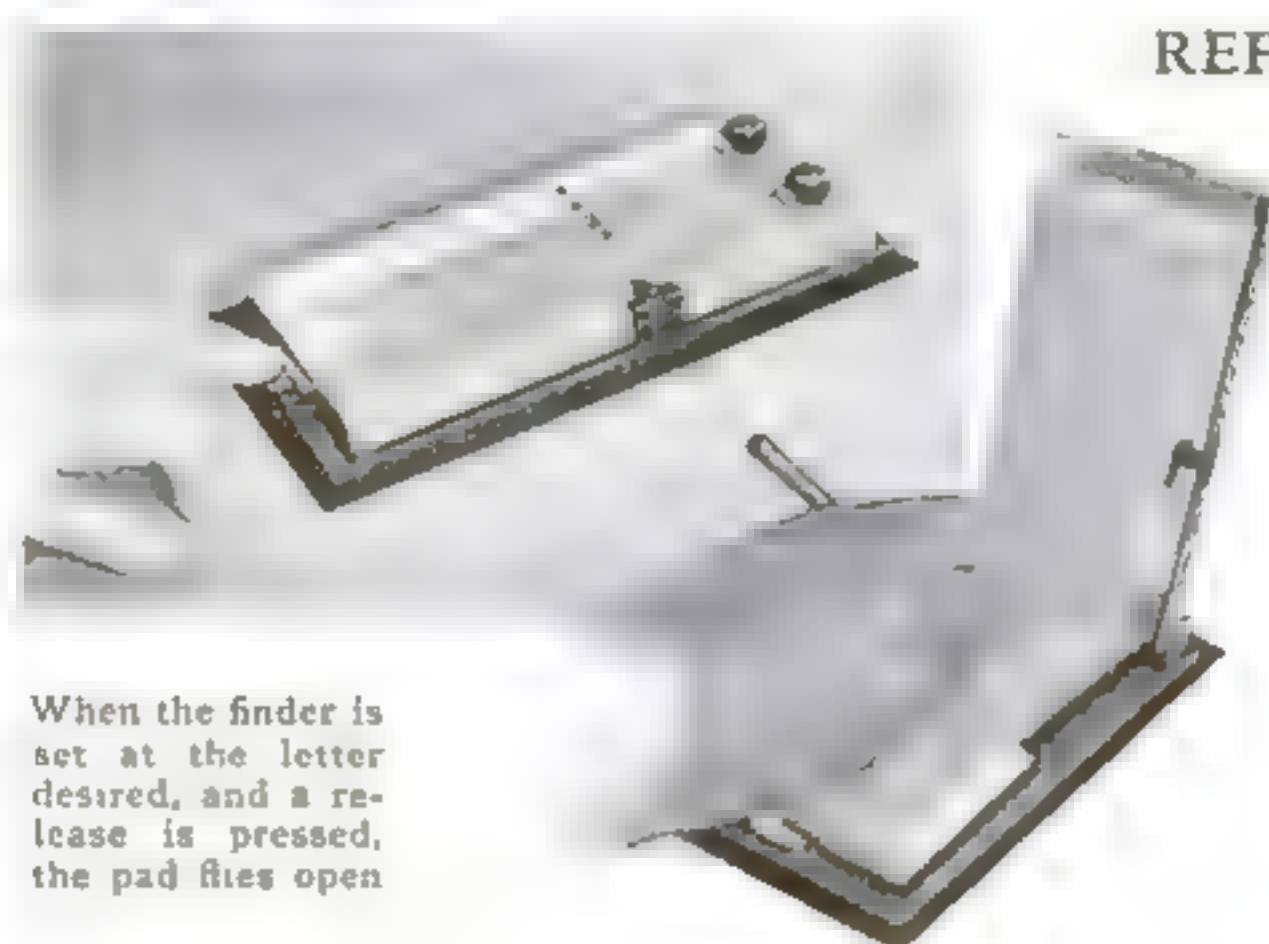
SHINY, metal-surfaced curbs that reflect automobile headlight beams are being used to increase night-driving visibility at the entrance to a vehicular tunnel in Liverpool, England. In liquid form, the metal is applied to the concrete with a spray gun which atomizes a continuous length of wire fed automatically into a high-temperature hydrogen-oxygen flame.



Scientifically designed chair for desk workers

OFFICE WORKERS GET OVERSTUFFED CHAIRS

TO ADD to the comfort of office workers and reduce fatigue, which leads to inefficiency, the overstuffed desk chair shown in the photograph above has been introduced. Armless, the chair is covered in a soft fabric and is scientifically designed to prevent strain by providing correct as well as comfortable working posture. The cushion is mounted on a wooden base with casters.



When the finder is set at the letter desired, and a release is pressed, the pad flies open

REFERENCE PAD OPENS AUTOMATICALLY

AN AUTOMATIC reference pad recently placed on the market is a handy accessory for locating telephone numbers or addresses quickly. Sliding along the edge of the pad, on which index letters are printed, a metal finder is held at the desired letter. A release is then pressed, and the pad automatically springs open to the correct page. In place of the lettered scale, numbered or dated indexes are also available.

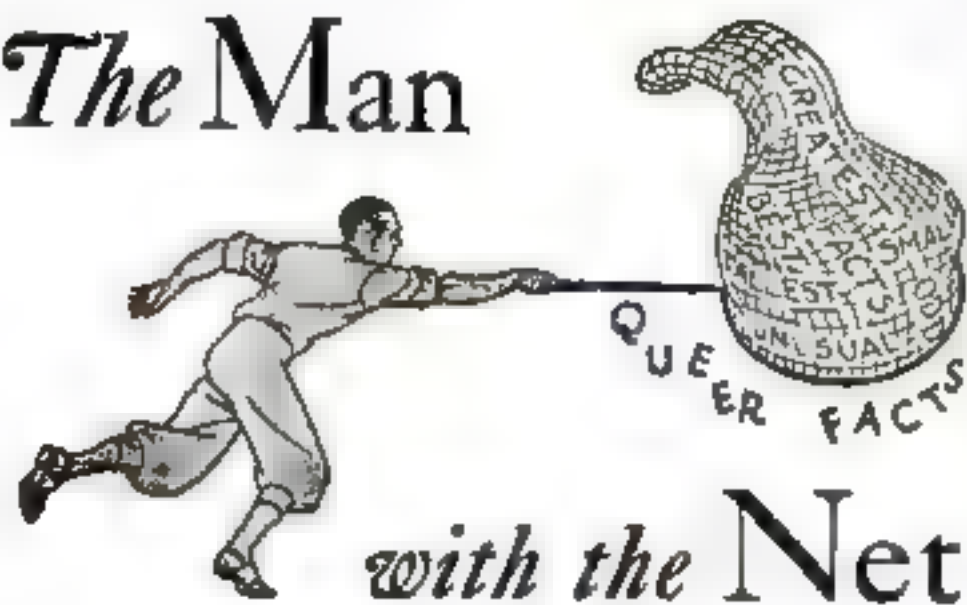
"BUMPOGRAPH" MARKS HUMPS IN ROAD

WHEELED along a highway under construction, a novel device designed by a California engineer locates and marks bumps and uneven places on road surfaces. A wooden frame, hinged for compact storage, is supported by four wire-spoked wheels. Suspended in the center, a chalking crayon is automatically adjusted to mark white streaks on uneven sections of the road to guide smoothing and grading operations. The "bumpograph" is said to be sensitive enough to mark bumps only one sixteenth inch high.



Rolled along a road surface, this novel device chalks the uneven places

The Man

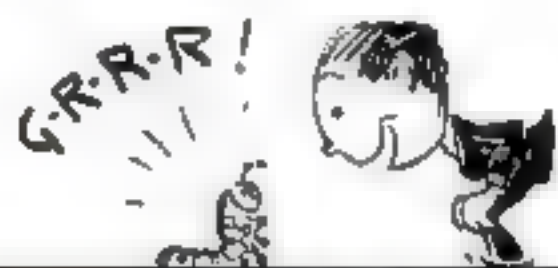


with the Net

ALUMINUM HORSESHOES are now manufactured for race horses.

CRANBERRIES are graded according to the way they bounce.

A CATERPILLAR has almost four times as many muscles as a man.



TWENTY-FIVE HUNDRED stars are the most an average eye can see from any one spot on the earth's surface.

AIR CURRENTS have carried small wingless insects 18,000 feet into the sky.

SEA-SHRIMP eggs are so small two dozen could rest on the head of a single pin.

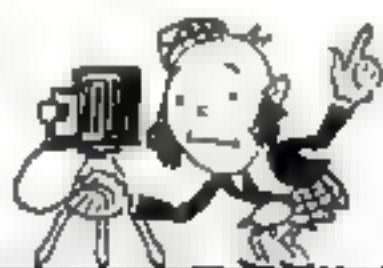
TOMBSTONES are being insured against damage or defects.



VARICOLORED pedestrian lanes are being tried on London, England, streets. White, yellow, or red is used, indicating the degree of caution necessary.

SIR WILLIAM HUGGINS, a noted British astronomer, made one four-by-five camera plate last for a year in photographing stars by cutting it into narrow strips and exposing each for weeks.

AYE, THAT'S BETTER-R-R THAN I CAN DO!



BUTTER, in oil form, has been preserved for as long as 100 years in India.

EARTHWORMS for distribution to orchard owners are raised by a California specialist.

BITUMINOUS COAL originally was known in England as sea coal, because waves first laid bare deposits on the seacoast.



TINY TOOLS FIT ON FINGER TIPS

ATTACHED to elongated thimbles, odd finger-tip tools invented by a New York woman are expected to facilitate the work of mechanics, artists, engravers, and other technicians. The tiny tools—brushes, screw drivers, eye droppers, etc.—eliminate the necessity of picking up first one tool and then another, and act as finger extensions.



A tool on each finger saves time spent in changing from one to another

DIESEL WEIGHS EIGHTEEN POUNDS

The inventor with his six-horse-power Diesel engine



CALLED the world's smallest Diesel engine, a diminutive power plant designed by Charles Keene, of Los Angeles, Calif., develops over six horsepower but weighs only eighteen pounds. Equipped with an ingenious fuel-injection system, the three-cylinder motor has a 1½-inch bore and a sixteen-to-one compression ratio. The tiny engine was constructed as a working model for a larger power plant intended to drive small airplanes.

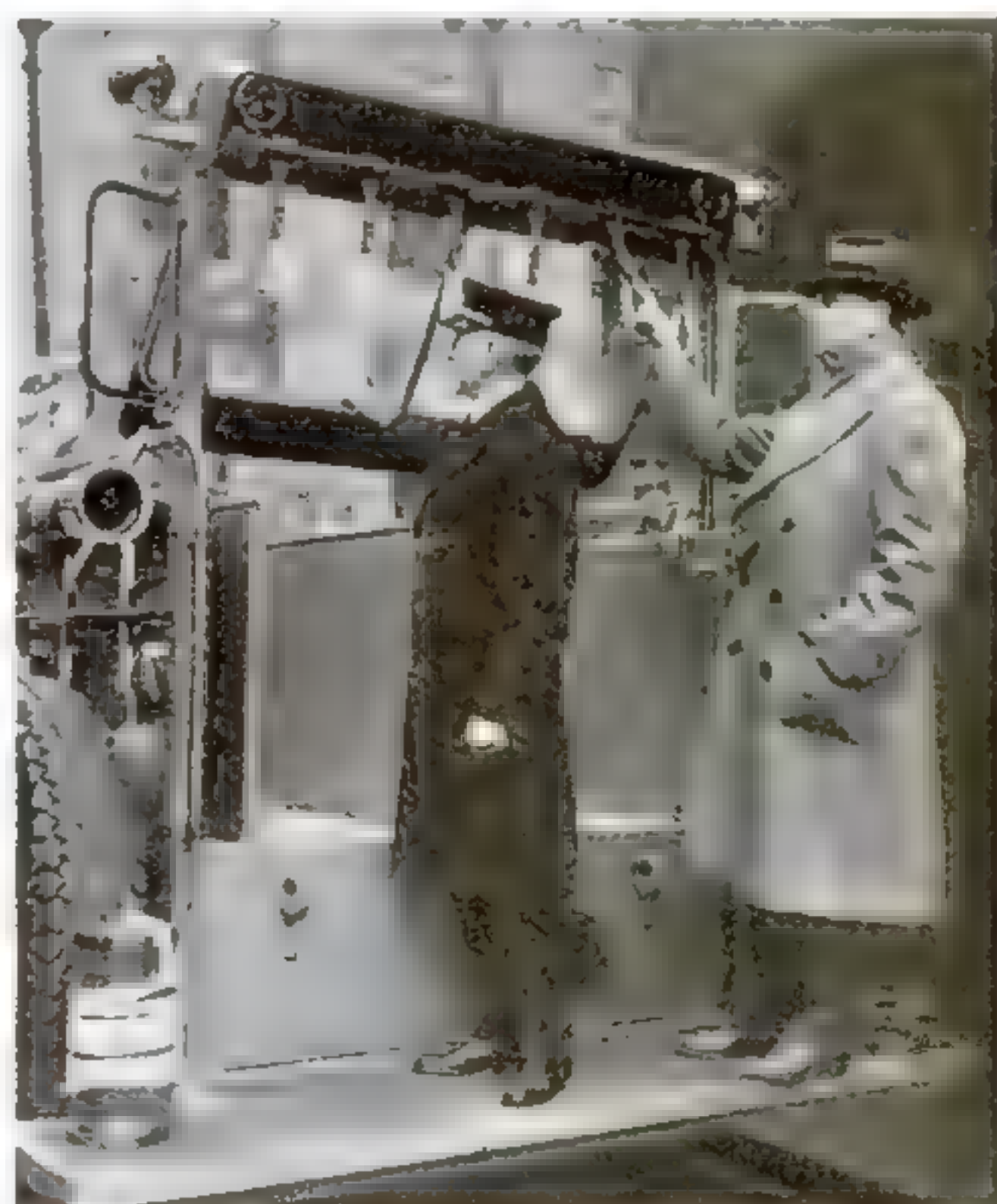
BATHING CAP HAS PNEUMATIC SEAL

SQUEEZING a rubber ball in the crown of a new-type bathing cap inflates a small rubber tube coiled around the rim, making the hat fit snugly at the edges, and forming a water-tight seal. Sponge-rubber cushions around the edges prevent discomfort.



FIRE TRUCK HAS NEW SAFETY HAND STRAPS

CLINGING to rigid metal hand holds, similar to those used in modern street cars and subway trains, firemen ride in safety on new hose trucks recently put into service in New York City. The new handles were adopted to overcome the disadvantages of the conventional leather straps, which become cracked and weakened in outdoor service. To give further protection to the men riding on the tailboard, the new trucks are equipped with a shatter-proof glass rear windshield fitted with wing-type wind deflectors. Semaphore-type direction signals and a flashing red light on the cab are added safety features.



Officials demonstrating the new-type hand straps and windshield

MIRROR HELPS COACH BASEBALL TEAM



A player being taught correct batting stance with the aid of a mirror

BASEBALL players at Villanova College, Villanova, Pa., are being taught the fine points of the game with the aid of a mirror. Held in a metal frame and rolled out onto the playing field, the looking-glass is placed in front of a player so that he can actually see his own faults as pointed out by the coach. In the photograph at the left, one of the coaches is shown giving advice on batting stance to a member of the Villanova team. The device is said to develop a good playing technique in a very short period of training.



MAP ON SIGN GUIDES VISITING MOTORISTS

LOCATION of parking spaces and garages, as well as other information helpful to motorists, is provided by a new type of street sign just installed in London, England. The information board is made in the form of a detailed map of the zone in which it is erected, as a convenience to visitors unfamiliar with the area.

SMOKELESS CIGARETTES USE AROMATIC OILS

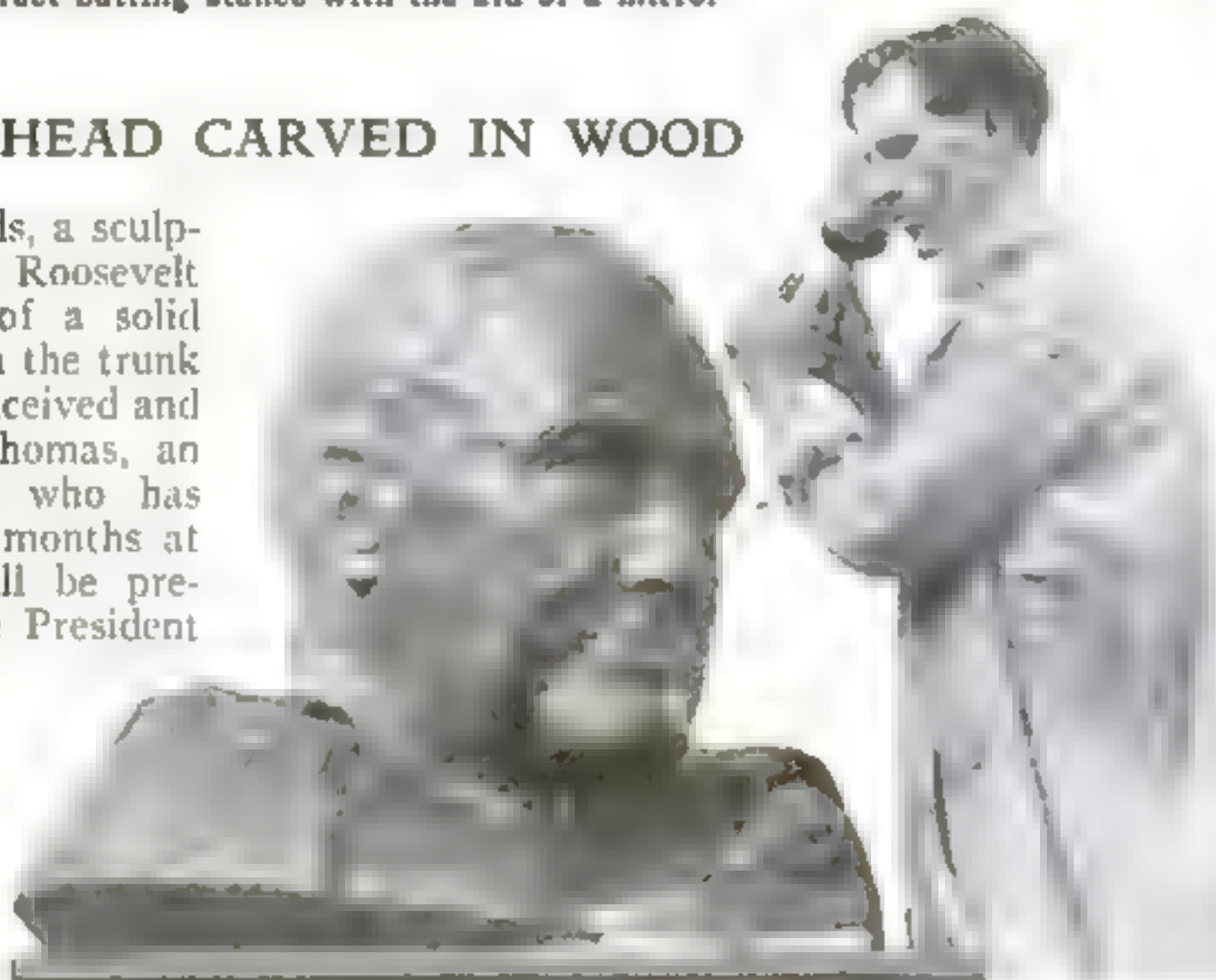
AROMATIC oils replace tobacco in a new smokeless cigarette. Made for persons who have to give up or moderate their smoking, the odd cigarettes are not lighted, but have end caps which, when removed, allow the "smoker" to inhale non-irritating fumes.



"Smokers" remove caps to breathe fumes

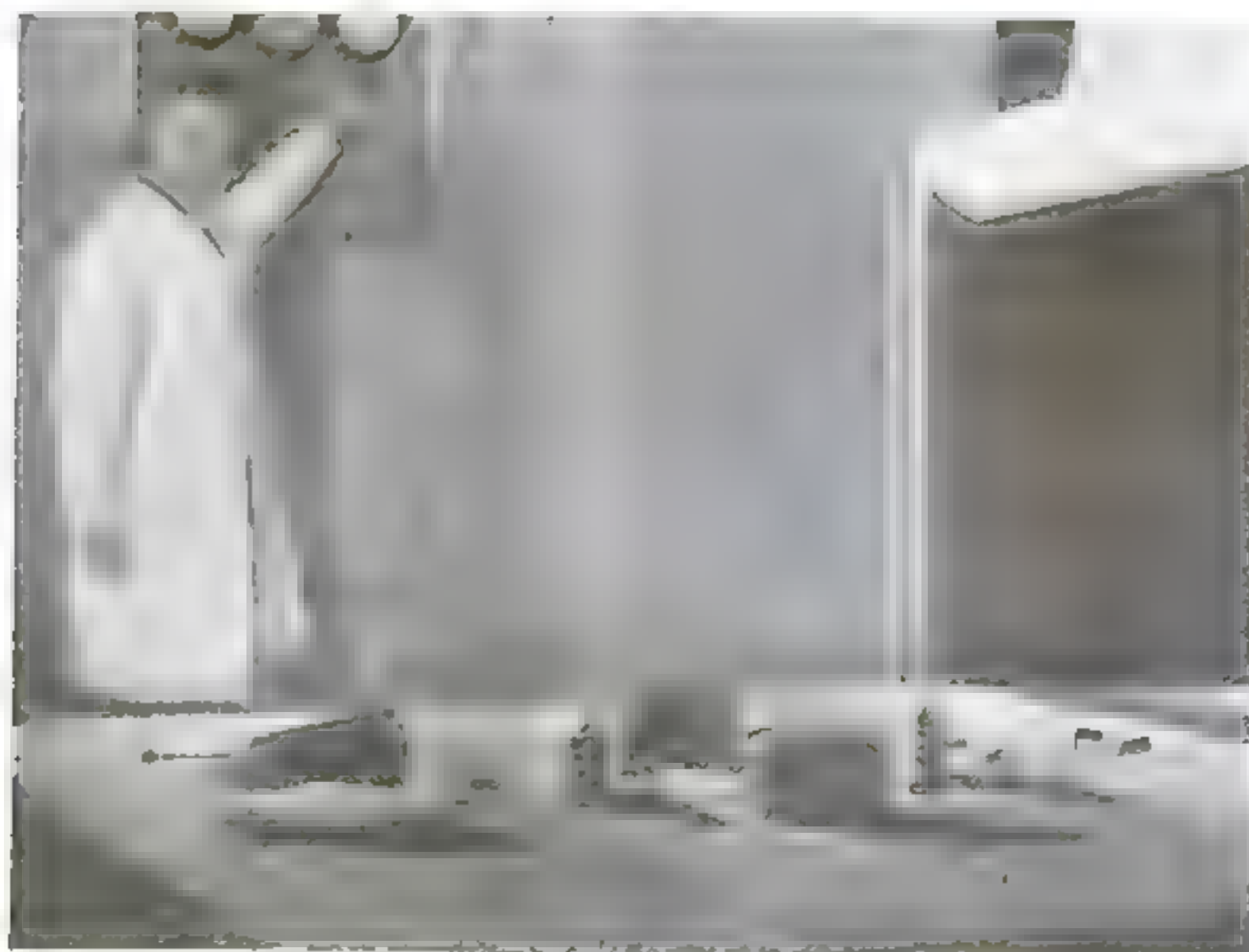
PRESIDENT'S HEAD CARVED IN WOOD

WEIGHING 400 pounds, a sculptured head of President Roosevelt has been carved out of a solid block of wood cut from the trunk of a large oak tree. Conceived and executed by Steffen Thomas, an Atlanta, Ga., sculptor who has worked more than six months at the task, the head will be presented as a gift to the President when it is fully completed. In the photograph at the right, the artist is seen plying his chisel with a wooden mallet to put a few finishing touches on the unusual piece of sculpture.



The trunk of an oak tree provided the material for this odd sculpture

WIND-TUNNEL TESTS OF MODELS AID CITY PLANNING



A Soviet engineer testing models of proposed buildings in front of a wind tube. Tiny celluloid flags show air currents and eddies, as seen at right

CITY PLANNING in Russia is aided by testing models of projected apartment houses and public buildings in a wind tunnel. Placed on a flat surface in front of the wind tube, the models create whirls and eddies of air that are studied with the aid of small celluloid flags. In this way, the best location with regard to prevailing winds, especially in respect to air pollution from industrial plants, can be determined before the buildings are erected.



NEW MATERIAL MAKES MODELING EASY

Sample of work done
in novel art medium



Outlining a design traced on a sheet of the new cellulose material. At the right, the design is being raised from the back



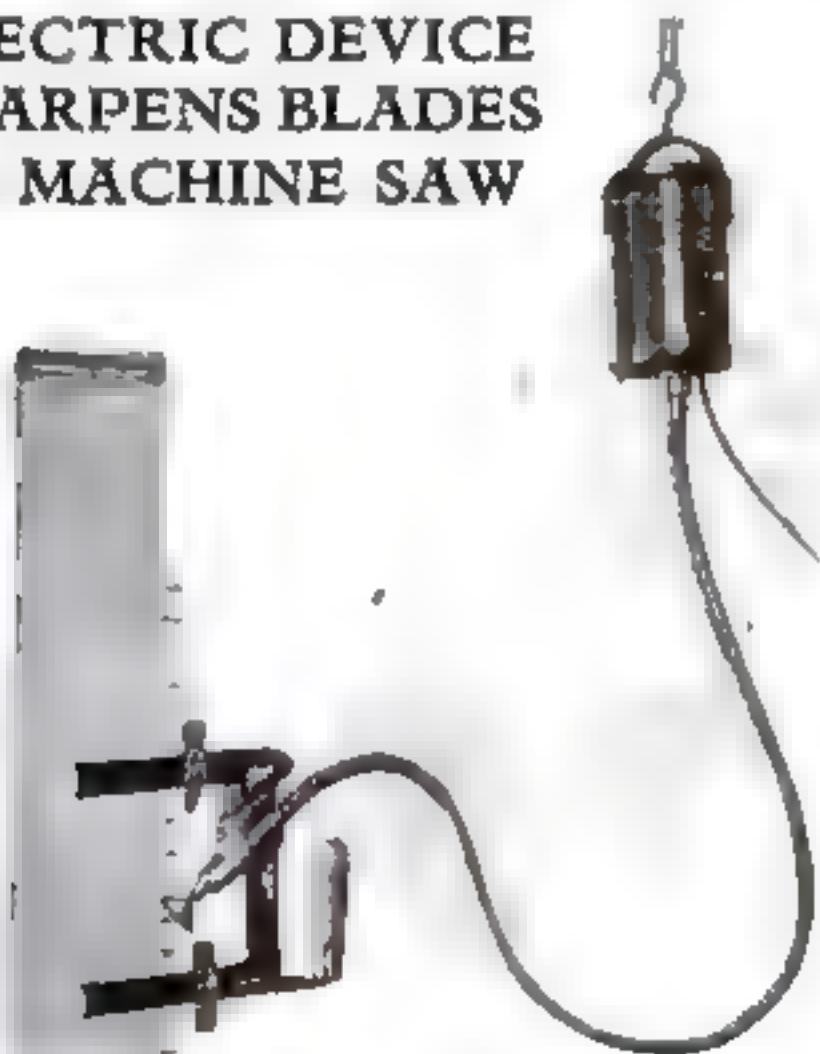
RUBBER EDGES ON DESK SAVE SILK STOCKINGS

BECAUSE rough, splintery desk edges often catch women's silk stockings and cause "runs," a new office desk has smooth corners made of rubber composition. The idea is expected to prove a boon to secretaries and other women office workers.

WITH a new modeling material, plaques, book ends, signs, and cigarette boxes can be decorated easily by the amateur. A pattern is traced on a sheet of the material with a hard pencil or a blunt instrument. After water has been run over the back of the sheet to soften it, the design is worked

up with regular leather-working tools, and then pressed out in relief by working from the back of the sheet with a modeling instrument. When protected with a coat of lacquer, the design is said to be permanent.

ELECTRIC DEVICE SHARPENS BLADES IN MACHINE SAW



Abrasive wheel set to sharpen a blade tooth

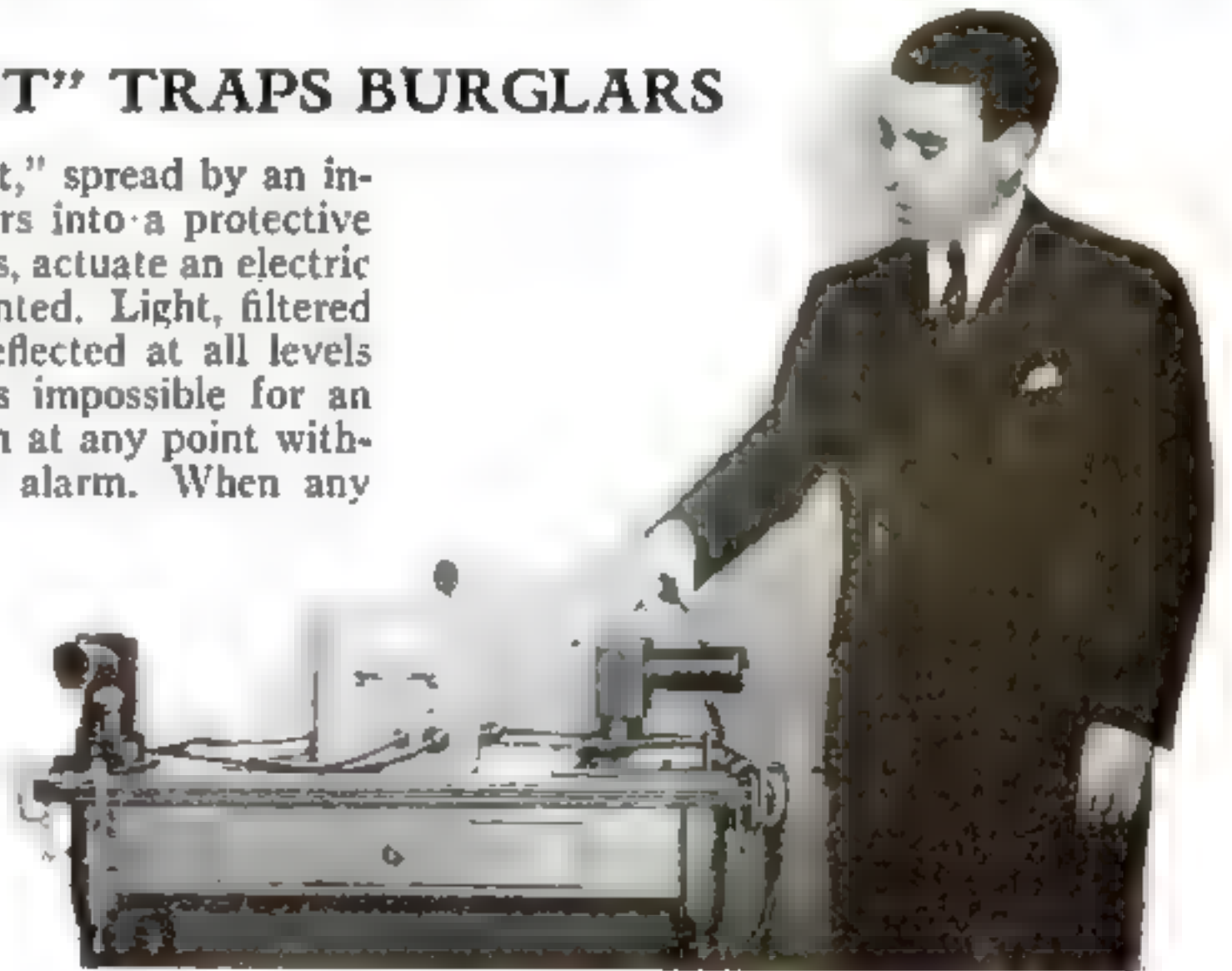
SHARPENING of machine-saw blades is facilitated by a new electric device introduced in Germany. Powered by a flexible shaft connected to an electric motor, a whirling abrasive wheel is held against a blade tooth by a U-shaped clamp. The device, moved by hand along the toothed edge, makes it unnecessary to remove a dull blade from a machine for sharpening.

CLOTH FOR BOOK PAGES

Books printed on a rayon-type cloth instead of on paper are forecast with the invention by a Czechoslovakian scientist of a synthetic fabric suitable for printing purposes. The new material, it is said, is very durable, and can be produced more cheaply than high-grade book paper.

"BLACK LIGHT" TRAPS BURGLARS

BEAMS of "black light," spread by an intricate system of mirrors into a protective network of invisible rays, actuate an electric burglar alarm just invented. Light, filtered of all visible rays, is reflected at all levels and angles so that it is impossible for an intruder to enter a room at any point without setting off a silent alarm. When any beam is interrupted, the mechanism dials a telephone and transmits a recorded message to summon police to the scene. The apparatus is also said to be sensitive to smoke and can be adjusted for use as an automatic fire alarm.



Rays of invisible light from this apparatus "patrol" a room

STEEL TRIPOD LEGS ROLL UP

COMPACTLY stored in a pocket-size case, three strips of strong spring steel are pulled out to form the legs of a convenient camera tripod just introduced. Similar to conventional steel measuring tapes, although much heavier, the extended steel bands are inserted in slots in the case, which is screwed tightly to the camera base.

Weighing less than one pound, the collapsible tripod is expected to be handy for photographers.



The tripod set up. The legs are steel strips like measuring tape



One of the legs being pushed into the pocket carrying case



A fishing camp in the high Sierras. Equipment is light and mobile without sacrificing real comfort

Ticks in

Damp spots are likely to bring mosquitoes, and the moisture may give you a cold. An open area gives you the benefit of any breezes, which also help to blow the mosquitoes away.

At elevations above 5,000 feet, take at least two days to make a permanent camp. Do not rush, for at high altitudes the lowered air pressure and diminished oxygen supply often induce headaches or digestive upsets. Those two days can be well spent tidying up camp, storing food, and gathering an adequate supply of wood.

Most people camp in tents. Since you will spend more than half your time in camp, make sure the tent and sleeping facilities are durable and comfortable. Several kinds and sizes of tents are available, from the small army-type "pup" tent, which is a single square of canvas stretched across a rope or pole, to the newest wall-type tents. Most modern tents have canvas floors, netting windows, and doors which may be closed by canvas flaps.

In erecting a wall tent, first stretch it out on the ground. Drive a stake at each corner, fastening the guy ropes loosely. Insert the horizontal ridgepole, put in the upright pole, raise it, and hold it in position while another member of the party drives in all stakes.

Of the thousands of mountain campers I see each summer, the majority prefer either sleeping bags placed on the tent floor or ground, or double beds. With the sleeping bag, which should be at least

thirty-six inches wide by seventy-six inches long, and fitted with a slide fastener to permit opening and airing, you will need for the mountains three wool blankets and a removable air mattress. Oddly enough, a sleeping bag is warmer on the ground than when on a cot, because in the former location cold air has no opportunity to circulate under it. The air mattress conforms to your body and is comfortable.

Ordinary cots and single beds are generally heavy, cold, and easily broken. If I am not to sleep on the ground, I prefer a double, collapsible spring bed. In making up a bed of this type, remember that all covers should stretch entirely across the bed and fold

ONE cold evening, while camped in western mountains two miles above sea level, a vacationist laid his sleeping bag between two fallen logs, built a fire near his feet, and went to sleep. At midnight he awoke suddenly to find his bedding enveloped in flames, his fishing equipment, camera, and meager supply of food destroyed, and fire crawling up both logs toward his head.

Another camper slipped from the edge of a low cliff while fishing a midwestern lake in late spring, and emerged, drenched, a few minutes later to hike six miles back to camp.

Again, a party of six anglers, without a guide, tied their creels and rods on top of a loose mule pack and set out along a mountain trail toward a lake. An hour later, they saw their equipment go bouncing down a steep cliff into an inaccessible ravine when a rattling pan frightened the animal.

These accidents represent three vacations ruined, at least partly, through carelessness or inexperience. All might easily have been avoided.

Within a few weeks, the nation's huge army of vacationists will head out from the cities to camp in valley, desert, and mountains. They will be seeking health, pleasure, and comfort in natural surroundings. Yet, unless certain fundamental precautions are taken, a camping trip may turn out to be neither healthy, pleasant, nor comfortable.

During a dozen years of advising tour-

ists how to camp, guiding hikers through the High Sierras of eastern California, and leading more venturesome hunters and anglers on pack trips to remote spots, I have learned a few rules which, if followed, will prevent many accidents of trail and camp, and send vacationists home happier, healthier, and eager to return to nature the following year.

To begin, make camp in an open area that is free from ants and mosquitoes and is open to the morning sun. Forget the luxuries of civilization and carry only enough food, clothing, and equipment for comfort. Vacation days should be spent vacationing, not washing pots and pans. Take your time during the first few days to avoid fatigue, windburn, and sunburn.

No matter whether you are enjoying the luxury of a trailer or pitching tentless camps on a several-day hike, avoid low, swampy ground or areas too near streams.



Live coals covered with a bucket will warm a tent

*These Practical Suggestions from an Old-Timer
Will Help You To Make the Most of Your Summer
Vacation Trip in Health, Comfort, and Pleasure*

By **NYLE F. SMITH**

Camping Out

TOLD BY AN
EXPERT GUIDE

down six inches or more. Three kapok or wool quilts are advisable. Cover these with a tarpaulin which also turns down six inches at foot and sides. Heavy safety pins help to hold them in place. Unless you have a thin, double mattress available at home, a kapok mattress will prove comfortable and easy to keep clean.

I believe in comfort and plenty of it, but at the same time I refuse to burden myself with unnecessary gadgets, such as hot water bottles, which have a habit of springing leaks at the wrong time. As a substitute, you usually can find plenty of stones around camp. After the dinner dishes have been cleared away and the camp fire has burned down to live coals or hot ashes, scrape part of the ashes aside, and place a stone measuring about six inches in diameter in them. When you think the stone is hot enough, pull it out and wrap it in newspapers. If it is too hot, the odor of burning paper will give warning. Remove the papers, wrap the stone in a small blanket, and place it in your bed a half hour before retiring. It will keep you warm until dawn.

In cold weather, it is easy to keep the entire tent warm. Dig a small, round hole in the earth, fill a two-gallon bucket with live coals, and turn it upside down in the hole. Seal the edges with dirt. Make sure, however, to use a pressed-seam and not a soldered bucket, or the pail will melt apart. Use only live coals in which no burning wood remains, or gases may lift the bucket and scatter the ashes.

Two points about camp fires are worth remembering. First, gather plenty of wood, to avoid having to search for it at night. Second, build a fairly large fire so you can cook over the coals, thus avoiding the discomfort of *(Continued on page 107)*

Delicious pies can be baked in a Dutch oven placed in live coals and with more coals in the lid, as illustrated below



For a temporary shelter, sling a single piece of canvas about twelve feet square over a rope stretched between two small trees or poles



Below, a lightweight pack rack loaded for a hike. Not more than forty pounds should be carried, with spare clothing easily available



A screened cupboard hung from a bough in a shady place, as above, will keep butter and other perishables fresh while protecting them from insects and animal raiders



Tent and bed are combined in this outfit, which folds into a compact bundle. It is appreciated by campers who dislike sleeping on the ground

Ocean Fishing for Everybody

Creates New Use for Retired Windjammers



NEW POPULAR SPORT

Sunset scene on one of the fifteen fishing barges anchored off the southern California coast. Right, a former derrick barge that now plays host to ocean anglers



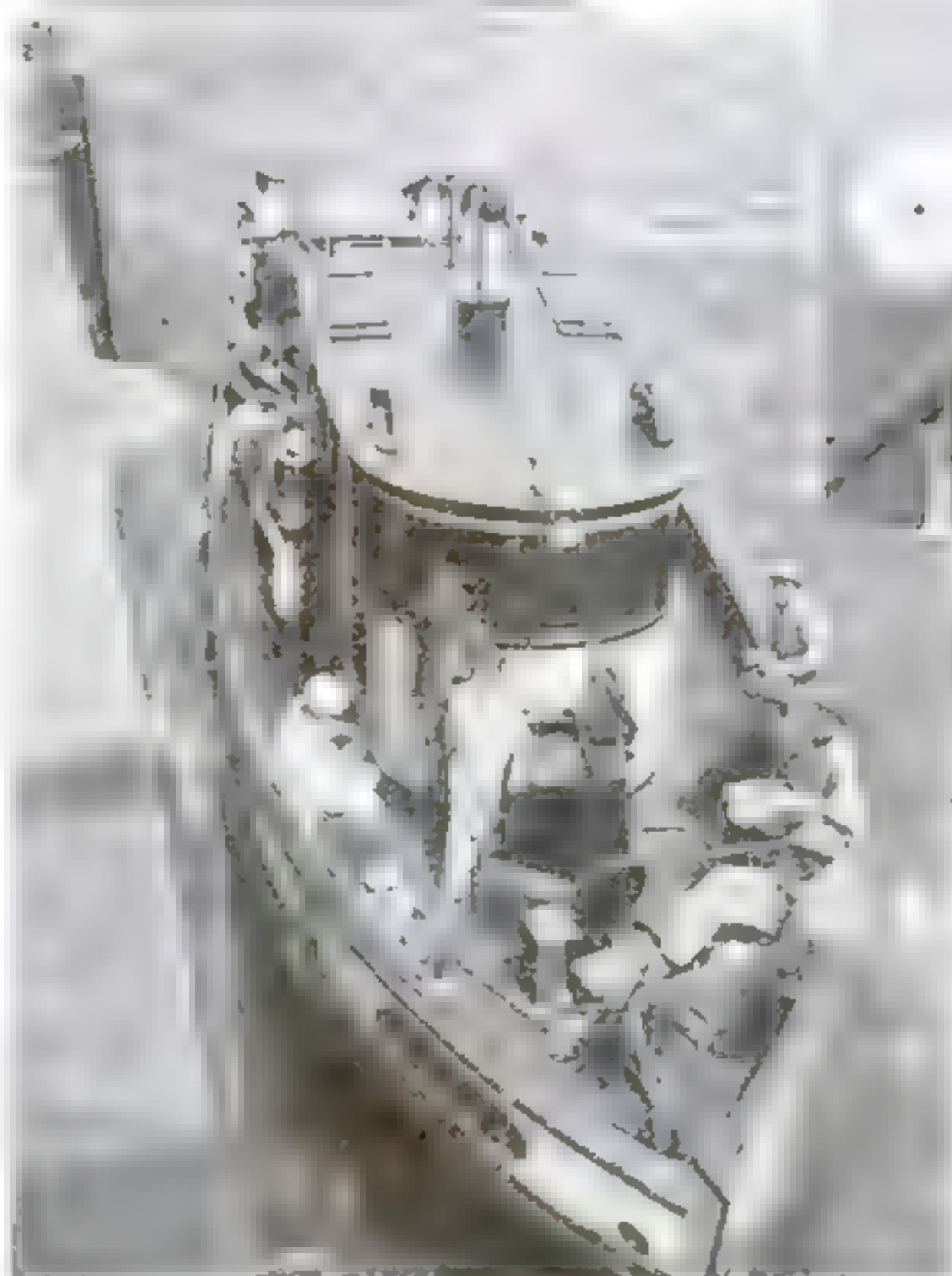
ANCHORED offshore along a 200-mile stretch of the southern California coast, a fleet of fifteen former sailing ships, some of them once well known on the seven seas, are bringing the thrills of deep-sea fishing within the reach of hundreds of thousands of sportsmen. Day and night, all the year around, their decks are crowded with men and women to whom, but for this novel type of floating club house, ocean angling would be an impossible dream.

For seventy-five cents a novice can step aboard a speedboat that taxis him to one of these dismasted windjammers. Once aboard, he is invited to select a pole, line, and hooks, the use of which is included in the fee. The barge captain explains the fine points of luring various kinds of fish, and an attendant baits the hooks with live sardines or anchovies, also supplied free. Each barge carries a restaurant at which sportsmen can obtain food while aboard.

More venturesome anglers can embark on a "live-bait boat," a small cruiser that carries from ten to thirty anglers several miles offshore. There it cruises about until good fishing is found, and then anchors while the customers hook fish ranging from deep-sea cod, weighing a pound or two each, to bonito sharks that tip the scales at 600 pounds or more.



Part of a day's catch of yellowtail and barracuda on one of the cruising "live-bait boats"



Reels fastened to the rail of a barge for paying out line into deep water for "bottom fish" such as the rock cod

ALL READY FOR A DAY AT SEA

A "live-bait boat" at the dock, about to put out to sea with a few anglers. In front of the pilot house is a bait well, full of live sardines and anchovies

FLYING LABORATORY TESTS FOUR ANTENNAS FOR STATIC



FOUR special antennas, installed in a twin-motored airliner, are undergoing tests to determine their resistance to rain and snow static, which occasionally interferes with two-way aircraft radio communication. The experimental aerials include a streamline "football" mounted on top of the plane, a split-ring type projecting from the nose, a rotating ring beneath the ship, and a fourth antenna located inside the flying static laboratory. Chairs on one side of the cabin have been replaced with apparatus for the tests.

This plane has four radio antennas—the "football" on top of the fuselage, a split ring at the nose, a revolving ring underneath, and a fourth antenna inside. The oval shows the inside of the cabin, with instruments for testing their anti-static qualities.



ODD PRACTICE FIDDLE FOLDS IN THE MIDDLE

HINGED in the center, a novel violin just introduced folds up into a small carrying case. After the strings are loosened, the instrument is bent in two, as demonstrated in the photograph by its owner, Dave Rubinoff, well-known radio and stage star. The collapsible fiddle has a muted tone and is handy for practice use.

BULLETS ARE CELLULOID

CELLULOID bullets that sting but do not penetrate the skin have been adopted by police of Paris, France, for use against mobs and political demonstrators.

BLOTTERS DRY RAZOR BLADES

SAFETY-RAZOR blades are said to stay sharper when dried in a new shaving accessory consisting of strips of blotting paper bound in a cardboard cover like a book of paper matches. Drying blades on a towel, it is claimed, spoils their fine cutting edge, while inserting them between the absorbent blotting sheets preserves their keenness. Sheets are labeled so that seven blades can be used in rotation.



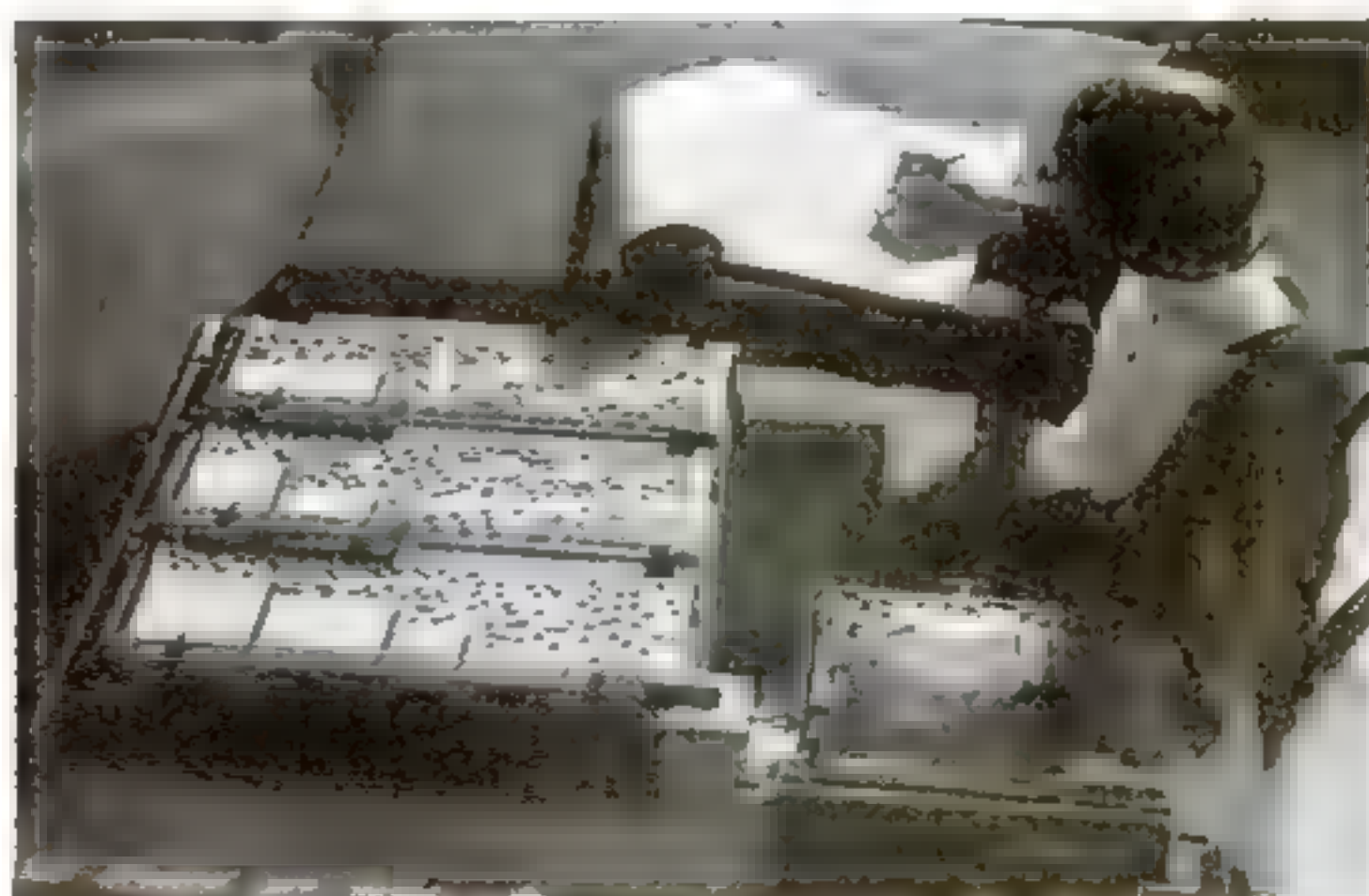
NEW FLASH-LIGHT BULB IS PREFOCUSED



AN IMPROVED flash-light bulb is prefocused to prevent distorted beams and to provide concentrated light. Fitted with a flanged base, the light has a filament extending to its pointed tip, enabling the makers to fix filament position accurately and thus insure a perfect focus. The photograph shows the new bulb, left, compared with a conventional type, and with a thimble to indicate size.

DEVICE GAUGES TELEPHONE TRAFFIC

TINY wooden counters, resting on continuous belts that move to represent the lapse of time, aid telephone experts to maintain efficient phone service. Each counter represents a "busy" trunk line, so that periodic checks on the number present on the belts give an approximate picture of the number of lines needed to handle a given amount of traffic at any time.



Wooden counters on moving belts represent "busy" telephone trunk lines



When flanged wheels are retracted, this gasoline-powered switch engine can run on pneumatic tires

SWITCH ENGINE RUNS ON RAILS OR ROAD

POWERED by gasoline engines and equipped with both automobile and rail-road-type wheels, a new switching locomotive operates equally well on rails or on level ground. Flanged steel wheels are re-

tractable, so that the locomotive can leave the rails and move directly to another track without having to maneuver back and forth along the maze of rails and switches found in a large freight yard.



IRONING MACHINE DRIES FLOOD-SOAKED MONEY

TO DRY OUT thousands of dollars in soggy paper money that had been soaked when floods hit Louisville, Ky., an official of a Federal Reserve Bank adopted the novel method shown in the photograph above. Obtaining an electric ironing machine of the rotary type used in homes, he fed the damp bills through it to steam out the excess moisture.

ANGLES ARE TRISECTED BY NEW DRAWING TOOL

AS A practical aid for designers, engineers, and other technicians, a New York draftsman has devised a novel instrument for dividing angles into three equal sections. Four metal prongs, joined at one end, are hinged together by movable spacing bars. When the outside prongs are placed along the edges of an angle, the inside prongs serve as guides for the trisecting operation, as illustrated below.



Inner prongs are guides for dividing an angle



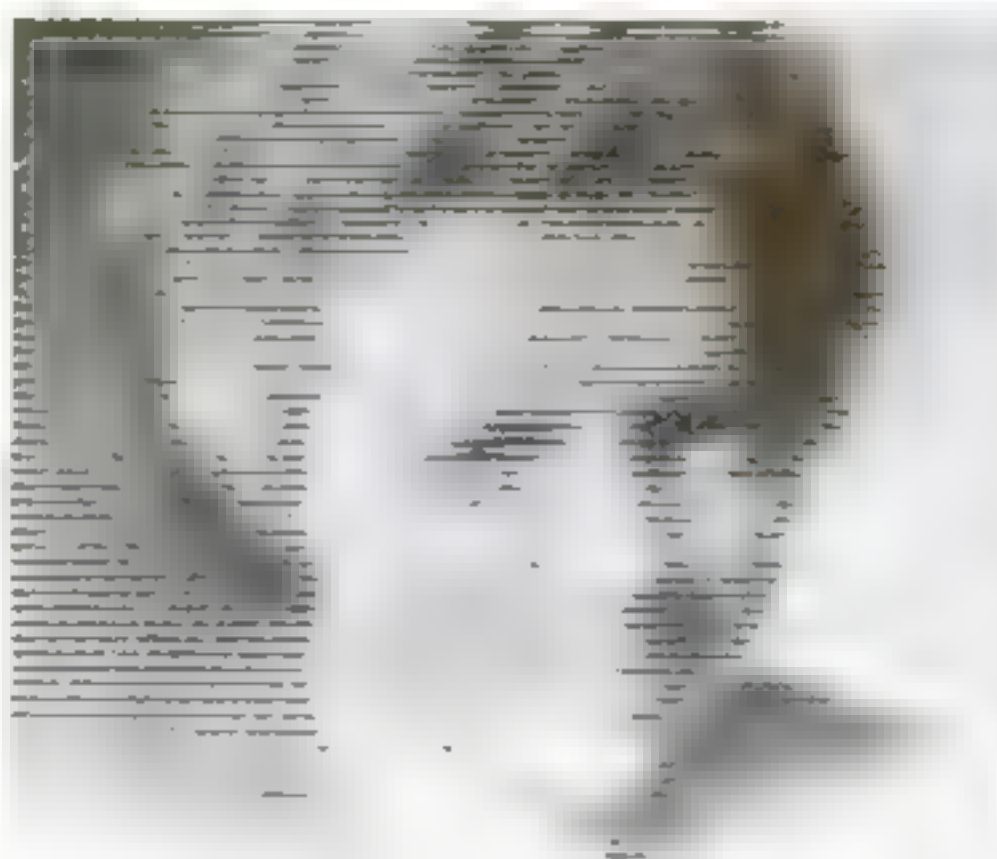
KING'S HORSES GET CORONATION DRILL

HORSES chosen to draw carriages in the coronation procession of King George VI of England were made accustomed to crowds and noises by extensive preliminary training in a London stable. Hitched to carriages, the animals walked between

double lines of cheering and shouting grooms, who waved flags, bunting, hats, and scarfs to simulate the actual conditions expected at the coronation festivities. Hundreds of horses were put through this preparatory routine.

PICTURES ILLUSTRATE TELEVISION PROGRESS

GREAT improvement in the clarity and detail of images transmitted by television is vividly illustrated by the two pictures reproduced at the right. The crude, blurred photograph is a reproduction of an image on the viewing screen of a television receiver developed about 1928, while the second illustration was transmitted by the latest equipment in a recent test broadcast. Modern apparatus produces an image having 441 lines to the picture, as compared with the sixty and ninety-line images of early television sets.



An early television image, at left, contrasted with one transmitted by the latest 441-line equipment



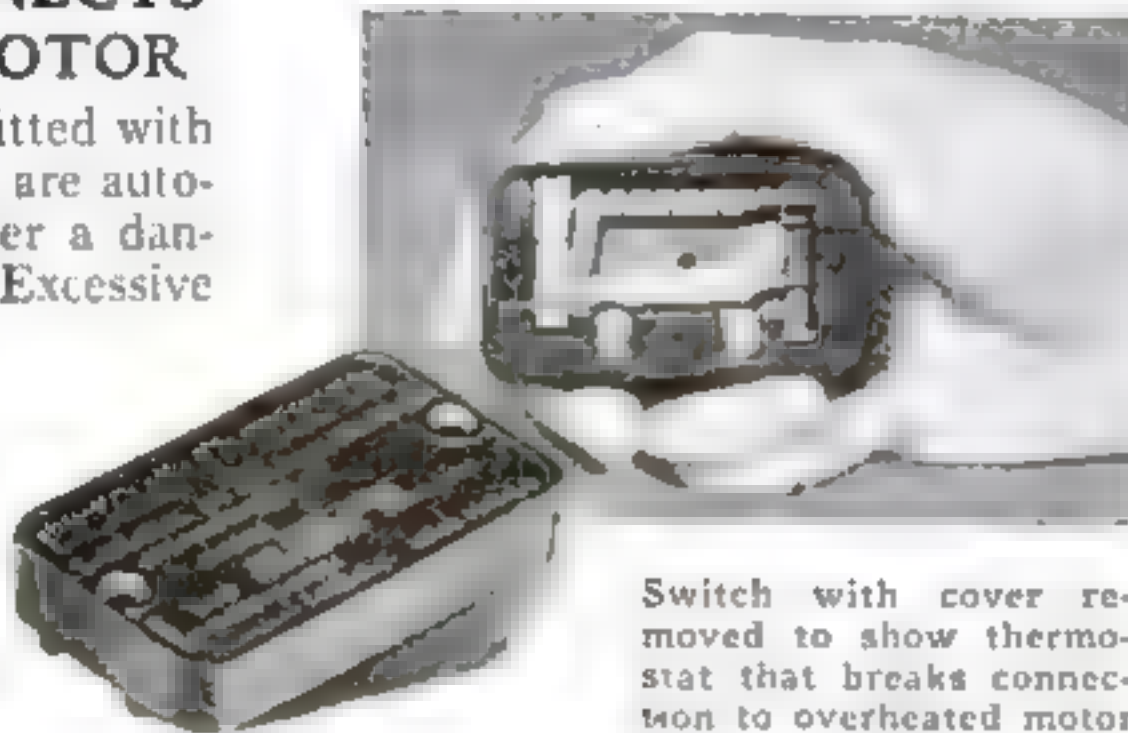
MOON PICTURES PRINTED ON GLOBES

ACTUAL pictures of the moon's surface, made through giant astronomical telescopes and printed on large globes by a photographic process, are helping scientists and students to visualize the appearance of the earth's satellite. In the novel process, which was devised by Dr. F. E. Wright, of the Carnegie Institution in

Washington, D. C., globes are coated with a light-sensitive emulsion and the photographs are projected upon them to produce likenesses of lunar craters and other topographical features. Various globes represent the moon in different phases.

SWITCH DISCONNECTS OVERLOADED MOTOR

SMALL electric motors fitted with a new thermostatic switch are automatically shut off whenever a dangerous overload occurs. Excessive current flowing in the circuit causes a built-in electric heater to warm a helix-shaped thermostat which expands and opens the switch contacts. When the temperature drops to normal, the contacts close.



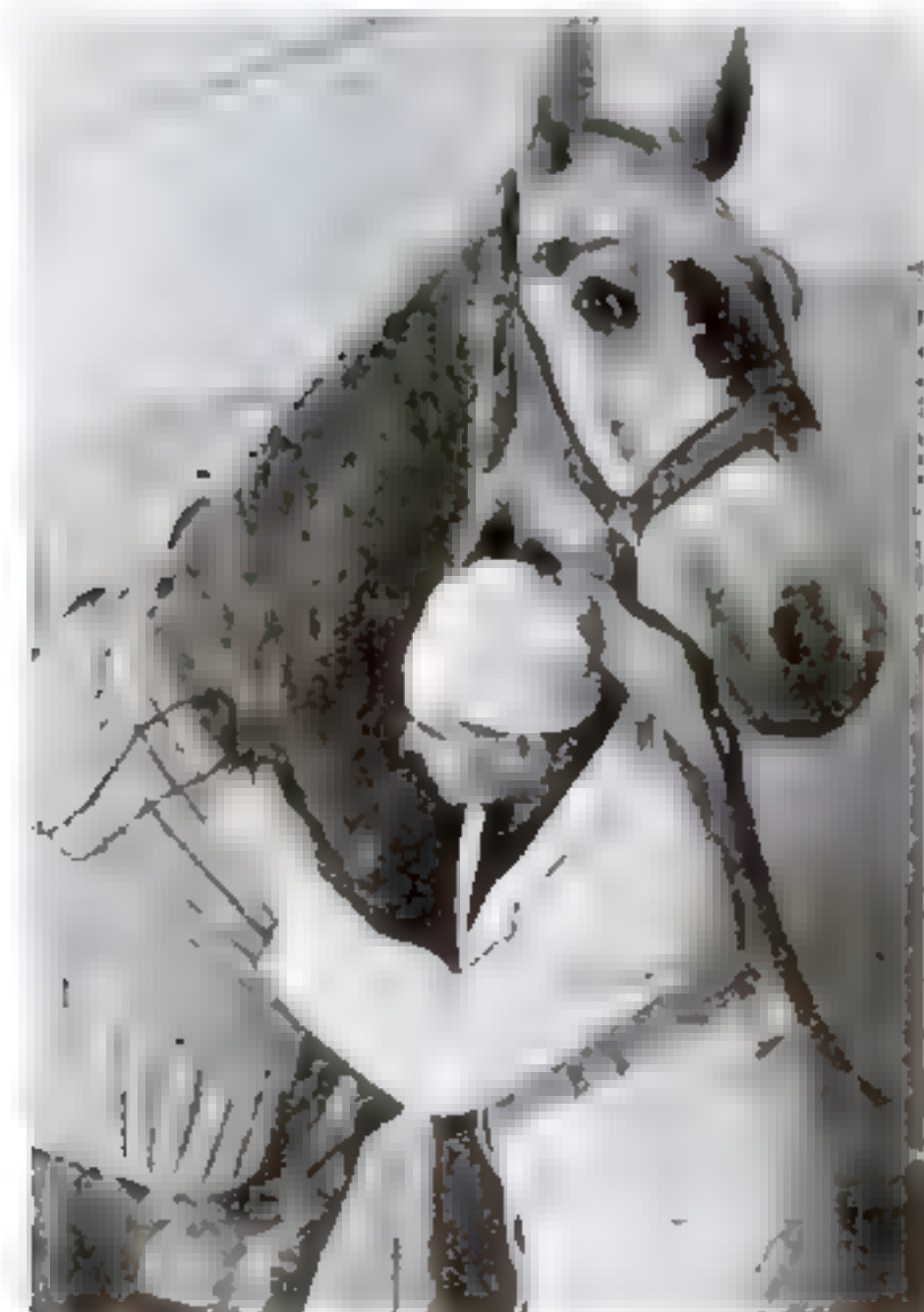
Switch with cover removed to show thermostat that breaks connection to overheated motor

ODD GASPROOF BABY CARRIAGE HAS BUILT-IN OXYGEN PUMP



Nurse demonstrating use of oxygen pump on gasproof "pram"

TO PROTECT infants in case of a wartime gas attack, an English inventor has perfected the odd gasproof baby carriage shown in the photograph. Sealed across the top with an air-tight glass cover, the pram is equipped with a hand-operated pump to force oxygen into the interior.



ELECTRIC WARMING PAD CURES AILING HORSES

AN ELECTRIC blanket for treating injured horses is part of the equipment being used by Russian veterinary experts at a large animal clinic just established in Moscow. In the photograph, the warming pad is shown strapped around an ailing farm horse's injured shoulder joint.

PLANE MAKES TRIP CHEAPER THAN CAR

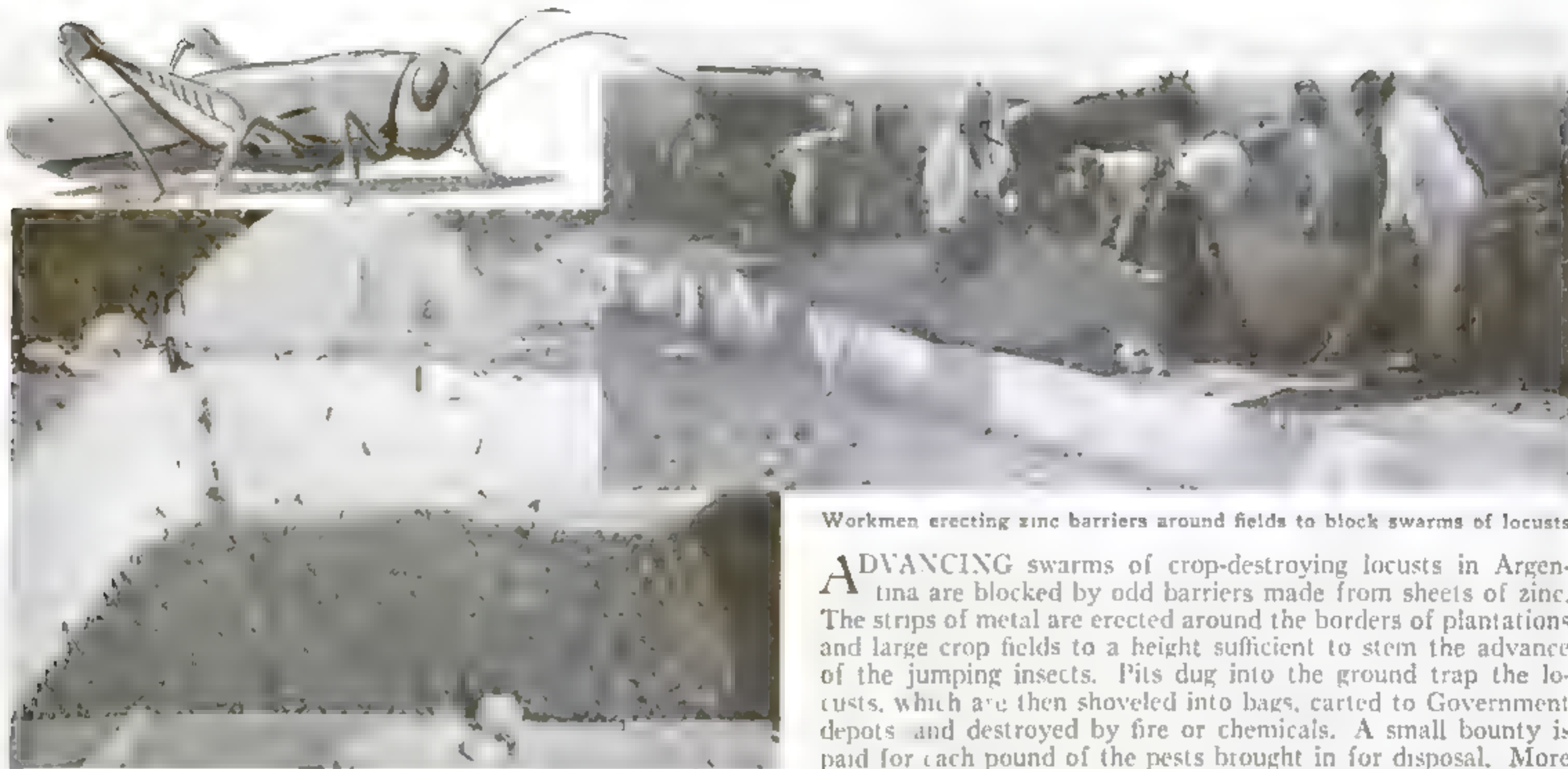
TO DEMONSTRATE the low fuel cost of a new airplane powered with an automobile motor, a test pilot recently made an air tour of New York State. When the gasoline consumption was compared with that of an automobile equipped with the same type of motor, it was found that the plane had used ten gallons less than the car, al-

though the same cities had been visited by both. The records disclosed that the plane had averaged sixteen air miles to a gallon of gasoline at an average speed of ninety miles an hour. Only one quart of oil had to be added to the plane's supply to keep up the crankcase level during the 750-mile trip.



Plane pilot and car driver comparing fuel consumption after a novel test of economy of air travel

Novel 'Locust Fence' Protects Crops



Deep pits like this trap thousands of the crop-destroying insect pests, which are brought to Government depots and killed by fire or chemicals

Workmen erecting zinc barriers around fields to block swarms of locusts

ADVANCING swarms of crop-destroying locusts in Argentina are blocked by odd barriers made from sheets of zinc. The strips of metal are erected around the borders of plantations and large crop fields to a height sufficient to stem the advance of the jumping insects. Pits dug into the ground trap the locusts, which are then shoveled into bags, carted to Government depots and destroyed by fire or chemicals. A small bounty is paid for each pound of the pests brought in for disposal. More than \$2,000,000 worth of sheet zinc has been purchased recently for use in constructing the barriers.

BIG ADDING MACHINE AIDS BANK WORK



Clerk entering check totals on mammoth calculator

DESIGNED for use in banks, one of the largest adding machines ever constructed was placed on display at a recent exhibition. The giant totalizer is said to do the work of a super-human bank teller, since it will add individual check totals, sort the figures into as many as twenty-four groups, and total each group as well as the sums of all the groups combined. Electric motors drive the complicated mechanism of the device, which is expected to speed up the complicated book-keeping operations encountered in banking. The mammoth adding machine is shown in use at the left.

COVER DIMS LAMP BULB DURING AIR RAID

MADE of a translucent blue glass, novel covers for light bulbs have recently been marketed in Switzerland for use during possible wartime air raids. Slipped over a lamp, the glass shade dims the glare so that the light can be used for reading or working, with little danger that it will be spotted by enemy planes. Supplementary bulbs in street lamps will be fitted with the blue dimmers and lighted in place of the regular white bulbs in case of surprise attacks by hostile aircraft.



Sliding glass cover over bulb to dim the light



ELECTRIC DEVICE ON BALLOON FORECASTS FOG

SOARING aloft fastened to a captive balloon, a delicate instrument just perfected by the U. S. Weather Bureau aids in forecasting fog. If, in ascending, the apparatus enters a warm layer of air of the kind that generally precedes fog formation, a small wire expands, closing an electrical contact. Tiny batteries then light a warning bulb, if it is night, or release a diminutive white parachute in the daytime. The instrument, pictured at the left, is expected to be of great value to air-line weather forecasters.

Un-Natural History By GUS MAGER



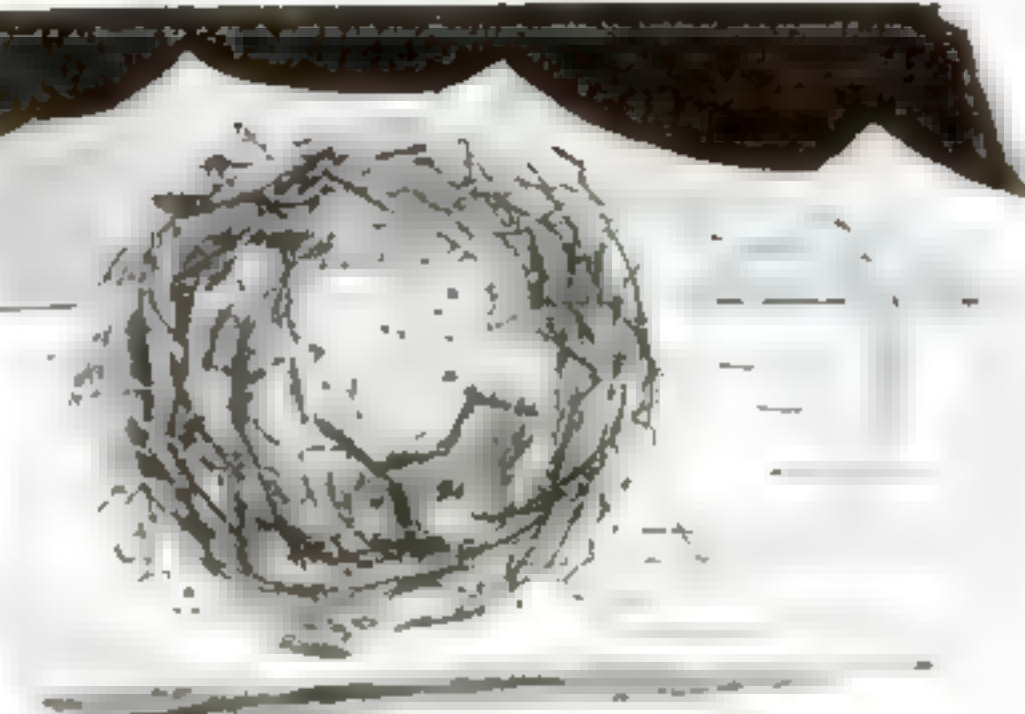
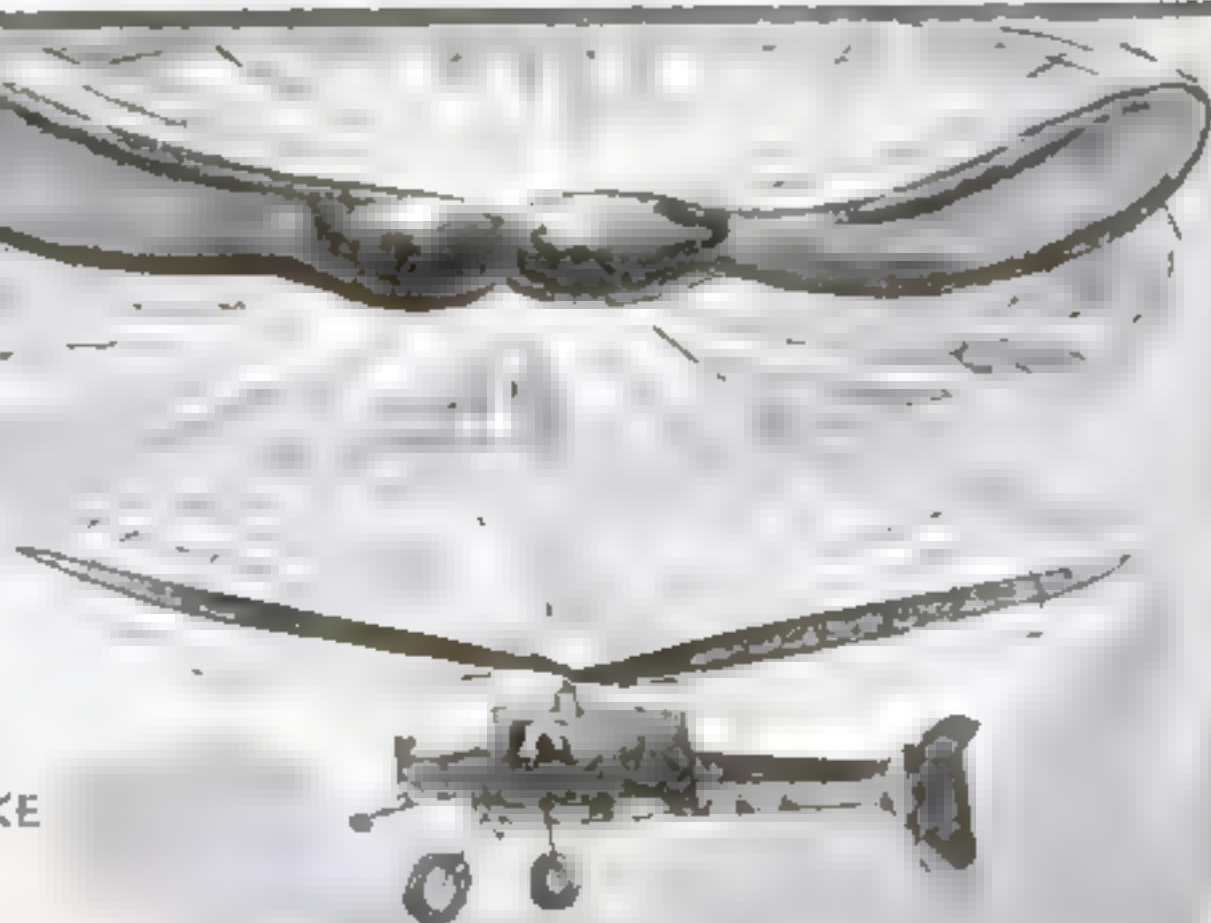
TO SEE what a good inventor old Mother Nature is, just look at some of the ingenious schemes she has worked out for broadcasting the seeds of plants—many of them anticipating modern human means of locomotion!



MANY SEEDS TRAVEL GREAT DISTANCES AS STOWAWAYS ON THE FEATHERS AND FEET OF BIRDS, OR AS HITCH-HIKERS IN THE FUR OF ANIMALS. OFTEN THEY ARE EQUIPPED WITH SPECIAL HOOKS, AS ON THE **BURDOCK** AND **BEGGAR-TICKS**, FOR CLINGING!

MAPLE "KEYS,"

CONTAINING THE SEEDS OF THE TREE, ARE TINY PROPELLERS THAT SPIN DOWNWARD THROUGH THE AIR, EXACTLY LIKE THE VANES OF AN AUTOGIRO!



THEN, THERE'S THE **TUMBLEWEED**, ROLLING ACROSS COUNTRY IN THE WIND WITH THE SPEED OF A HIGH-POWERED CAR, TO CARRY ITS SEEDS TO FAR-AWAY PLACES!



THE **DANDELION**, LIKE MANY OTHER PLANTS, SENDS SEEDS UP IN THE WIND LIKE BALLOONS, TO COME DOWN AGAIN LIKE MINIATURE PARACHUTES. ITS STEM STRETCHES FAR ABOVE THE SURROUNDING GRASS TO GIVE THE AERIAL TRAVELERS A GOOD TAKE-OFF!

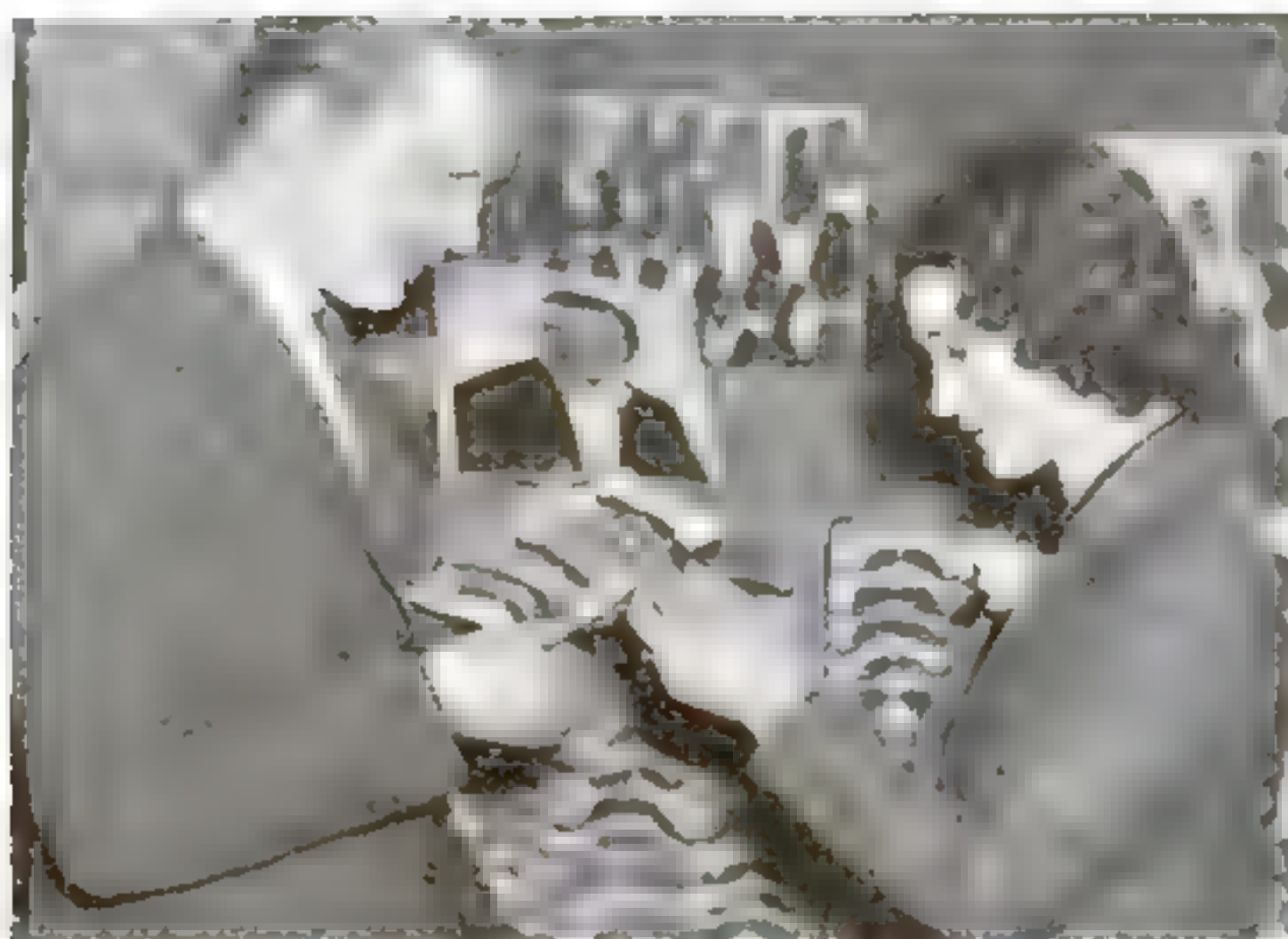
BIG COCONUT SEED PODS SAIL THE SEVEN SEAS LIKE SHIPS, CARRIED BY OCEAN CURRENTS. THE CARGO OF SEEDS IS CAREFULLY STOWED IN AN AIR-FILLED HOLD AND PROTECTED FROM THE ACTION OF SALT WATER BY THE FIBER COVER!



THE **JEWELWEED** IS THE ORIGINAL POPGUN! IT **SHOOTS** OUT ITS TINY SEEDS AT THE SLIGHTEST TOUCH OF THE LITTLE TRIGGER AT THE END OF THE CAPSULE!



MUSTACHE FILE SUPPLIES MOVIE STARS



Alfred Adler, film actor, selecting a false mustache for a new rôle

MORE than 1,000 different kinds of false mustaches, ranging from the old-fashioned "handle-bar" type to the wispy lip shadows of more modern days, are attached to cards and kept on file in the costume department of a major film studio in Hollywood, Calif. Actors thus can be fitted with the correct type for any rôle they may have to play. Actor Alfred Adler is here shown selecting a mustache.

Dogs can hear this whistle plainly, but it is almost inaudible to humans



TEST CONDUCTIVITY OF HOSE STREAMS



Scientists determining the distance from which firemen can safely play hoses on "live" wires

BY DIRECTING a hose at a "live" electric wire, fire streams were tested recently for electrical conductivity by C. S. Sprague and C. F. Harding, of the Engineering Experiment Station at Purdue University,

Lafayette, Ind. An electric meter between the nozzle and the ground measured the current carried by the water to determine the distance from which firemen can safely play hoses on high-voltage power lines.



ODD "SILENT WHISTLE" HELPS TRAIN DOGS

FOR TRAINING dogs without annoying neighbors, a novel whistle just marketed has an extremely high-frequency tone that is said to be easily detected by dogs but practically inaudible to the human ear. The tone of the silent air whistle can be changed by turning a thumbscrew built into one end.

WOOD MADE FIREPROOF

FIREPROOF "concrete lumber" is now being used in the construction of small homes, factories, and mine shafts. Boards one inch thick are given a coating of firmly bonded cement, and in this form may be used for fireproof walls and roofs.

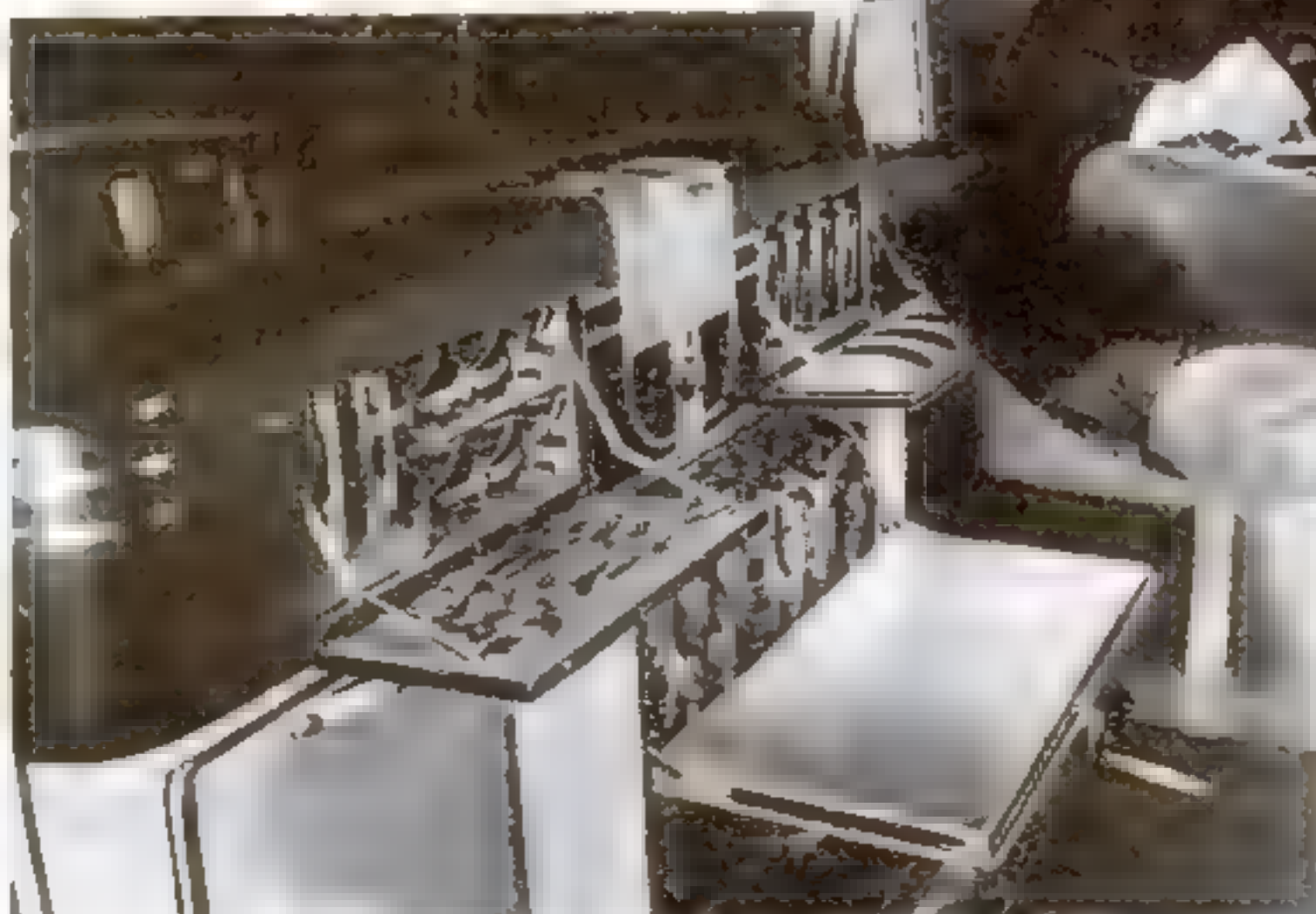


RUBBER TOOL REMOVES HEADLIGHT BULBS

HEADLIGHT bulbs are quickly and safely removed with the aid of a handy new automobile accessory. Made of specially cured rubber in the form of a short, hollow cylinder, the lamp "gloves" have molded flexible ribs on their inside surfaces to insure a secure, non-slip hold on the bulb while it is being replaced. The rubber unit, shown in the photograph above, is obtainable for headlight bulbs of all sizes used on automobiles.

CAR HAS DESK, CUPBOARD, AND BAR

WRITING DESK, food bin, beverage compartment, and other conveniences are built into a special automobile just delivered to Major Edward Bowes, radio impresario. Compartments set into the back of the front seat house glassware, china, cutlery, and beverage bottles.

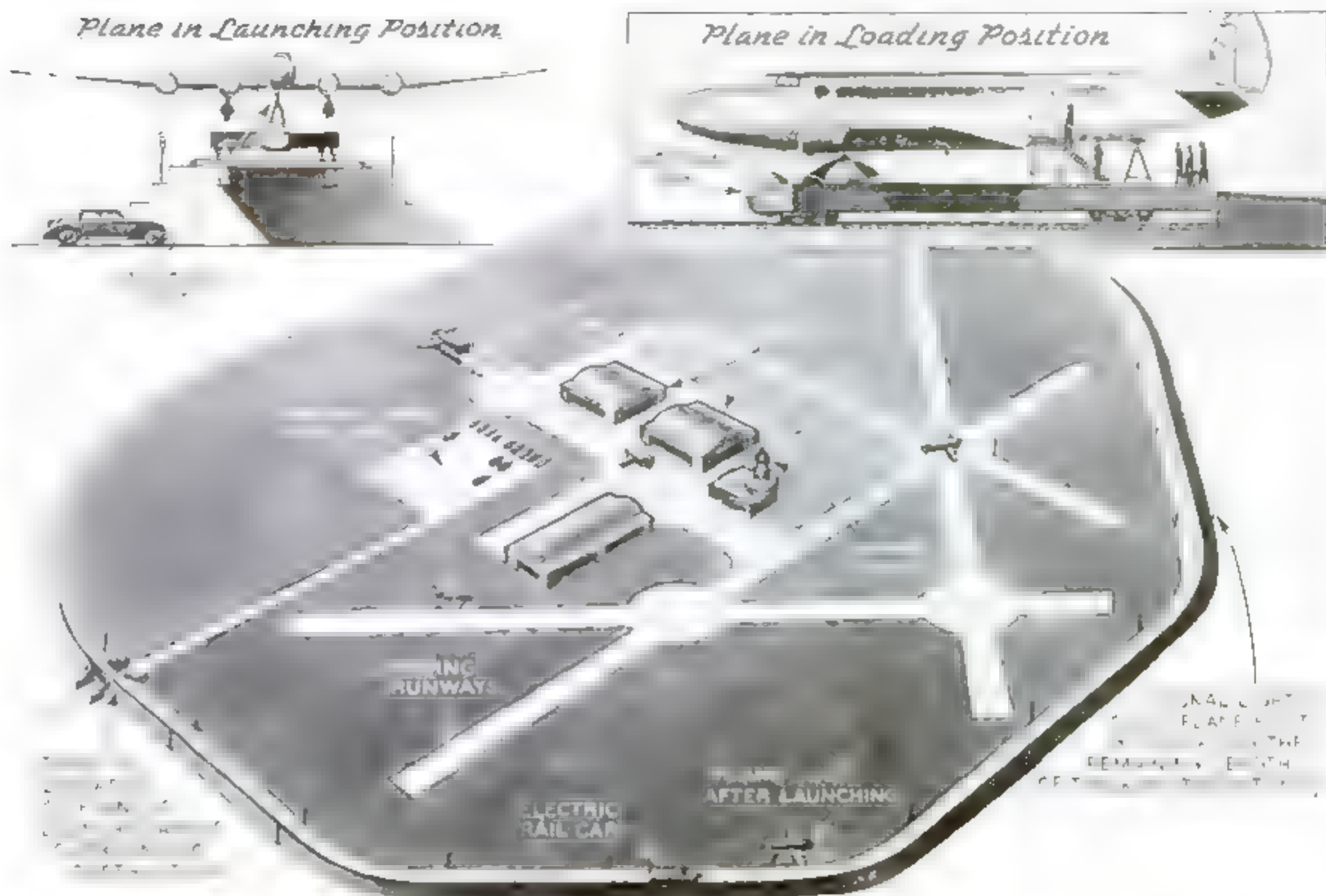


Major Bowes using the writing desk built into an arm rest in his luxurious automobile

Left, compartments for glassware and beverage bottles in the back of the front seat

Bulletlike Rail Car Launches Giant Planes

RACING along a wide-gauge track at 150 miles an hour, electrically driven streamline cars will launch giant transport planes, according to a plan proposed by Emil Doehler, of Buffalo, N. Y. Encircling the airport to provide take-off angles into any prevailing winds, the track is elevated above neighboring obstructions. On the flat rail car, the plane is supported in flying position by an adjustable tail support and a mechanically operated launching pivot mounted between the landing wheels. Climbing a ramp from a loading platform, the electric car accelerates to maximum speed and the plane pilot, guided by trackside signal lights, trips a release lever to launch his craft into the air. The scheme is expected to overcome present take-off hazards.



Plan of proposed airport with encircling wide-gauge track from which fast rail cars will hurl huge planes into the air



Some of the striking works of art created by John Adams, seen at left engaged in his unusual hobby

MAKES SAND PICTURES IN GLASS JARS

MAKING pictures and designs by placing brilliantly colored sand in glass jars is the odd hobby of John Adams, of Roseville, Calif. To make one of his pictures, Adams clamps a jar in a wire holder, places bits of sand inside with the aid of a long-

handled spoon to form the desired image upside down, and carefully tamps the grains with a stick. When the picture is completed, the jar is sealed with plaster of Paris and inverted on a base. Sand of twenty-seven different shades is used.

NEW CAR WAX RESTORES COLOR TO FINISH

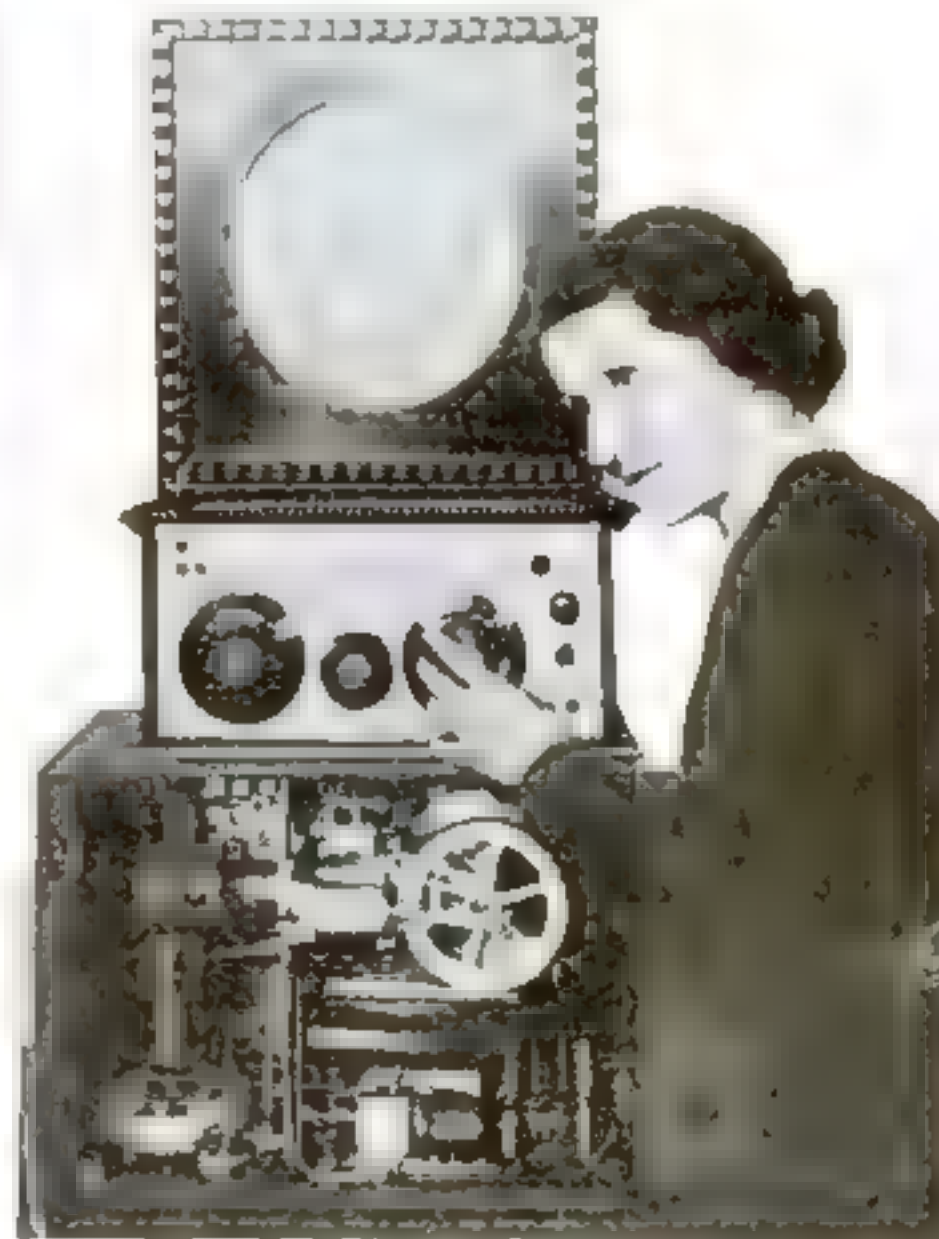
MADE in six different shades, a new type of automobile wax is said to restore color to a faded automobile finish. Applied in the usual manner, the wax leaves a glossy surface which contains pigments that blend with the original color of the car. The material also can be used as a cleaning agent for removing dirt, grime, and tar. In selecting the wax for his car, an owner chooses the one of the six shades that covers the general color group to which the car finish belongs.



Motorist applying wax that contains coloring material

OIL LAMP RUNS DYNAMO TO OPERATE RADIO

A KEROSENE lamp provides electric current to run a radio receiver recently exhibited in Germany. The lamp heats water in the boiler of a small steam engine, which runs a dynamo to generate current for the tubes. The kerosene-powered set, seen below, was designed for use in isolated spots where electricity is not available.



A steam engine generates current for this radio

TUBE CARRIES RADIUM

RADIUM "bombs" used for treating patients in a hospital in London, England, are blown from the thick-walled storage safe to the treatment mechanism through pneumatic tubes, and returned in the same manner, to avoid exposing staff members to the dangerous radiations.



When Clifford Potts wants to show movies to his friends, a screen rises into place as shown at the left. Below, Potts is manipulating controls in a table drawer, while a picture slides down on the wall to uncover the concealed projection window



Home Movie Theater

OPERATED BY REMOTE CONTROL

OPENING the drawer of a small table in the living room of his New York apartment, Clifford Potts, a home-movie enthusiast, presses a series of buttons mounted on a built-in panel. Slowly all lights begin to dim. A small screen silently glides up an end wall, while a picture slowly slips out of place on the opposite wall to reveal a glass-covered projection window. Just as the last glimmer of light fades, a moving picture appears on the screen, and the show continues for as long as an hour, to the accompaniment of music from a radio or from phonograph records mechanically synchronized with the film. At the conclusion, other buttons are pressed, the lights build up slowly to full brilliance, the screen disappears, and the wall picture slides back into place. Without any bustle of preparations, or the annoyance that usually is involved in putting apparatus and equipment away, a complete movie show has been presented entirely by remote control.

All the mechanisms for the movie presentation are actuated by switches and buttons within the table drawer. Fitted with oversize reels, the projector is mounted in a large clothes closet soundproofed with discarded bedding. A phonograph turntable and pick-up are located beneath the projector, while above it a shelf houses the sound amplifier and the rheostats that control the living-room lights. One electric motor operates the sliding picture that hides the projection window cut into the closet wall, and another drives the rolling mechanism that hoists the screen, which normally is hidden by window drapes and a living-room table



The projector on a special mounting that makes rethreading easy. Note the synchronized phonograph beneath the table

Projection mechanisms and sound effects are controlled from this drawer. The hand is on the tuning dial of the radio



The motor that raises and lowers the screen is hidden by window drapes and by the living-room table, as seen in this photograph

How the remote-controlled theater is arranged. The projection booth is a closet soundproofed with old bedding

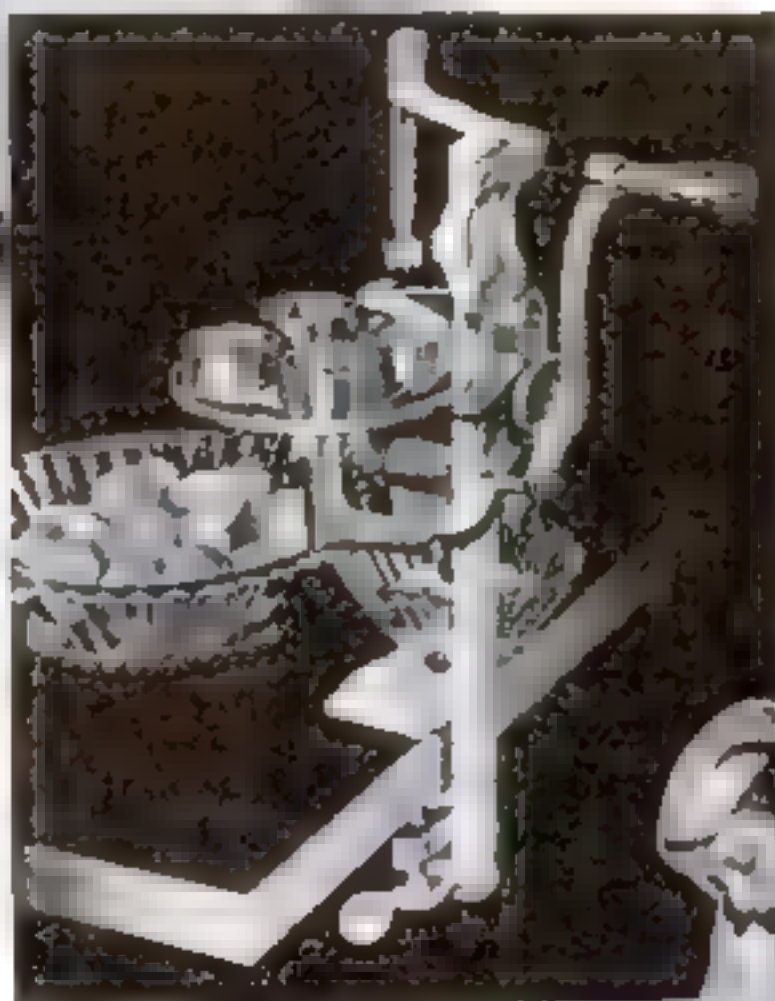
Latest Inventions FOR THE HOUSEHOLD



BIN FOR VEGETABLES

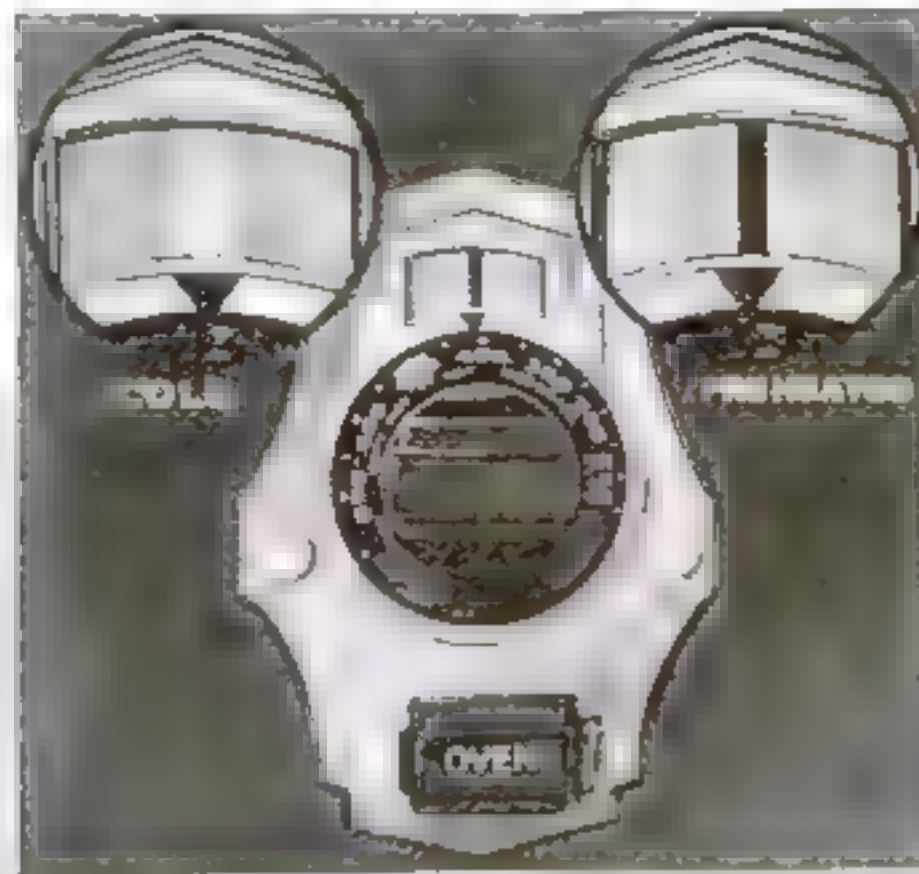
A feature of a new refrigerator is a humidified compartment for vegetables. It maintains a temperature around forty-five degrees

CHERRY SEEDER. Turning the handle of the machine shown at the right operates a thin steel plunger and a synchronized turntable to seed the cherries neatly



CABINET CONCEALS BED

A comfortable bed, complete with mattress, springs, pillow, and linen, is housed in the compact piece of furniture pictured at the right. The lower "drawer" is opened up to form the bed, while mattress and bedding come out of the upper compartment, as illustrated in the photograph below



OVEN-HEAT CONTROL

of a new type signals the housewife when the oven has reached the temperature desired, by means of a red indicator that appears in a window just above the dial



TOASTER HAS WARMING TRAY. Latecomers at the breakfast table find their toast piping hot when it is placed on the warming tray of a new toaster. Attached to the top of the appliance, the tray has a turned-up edge to catch melted butter, and is easily removed for washing



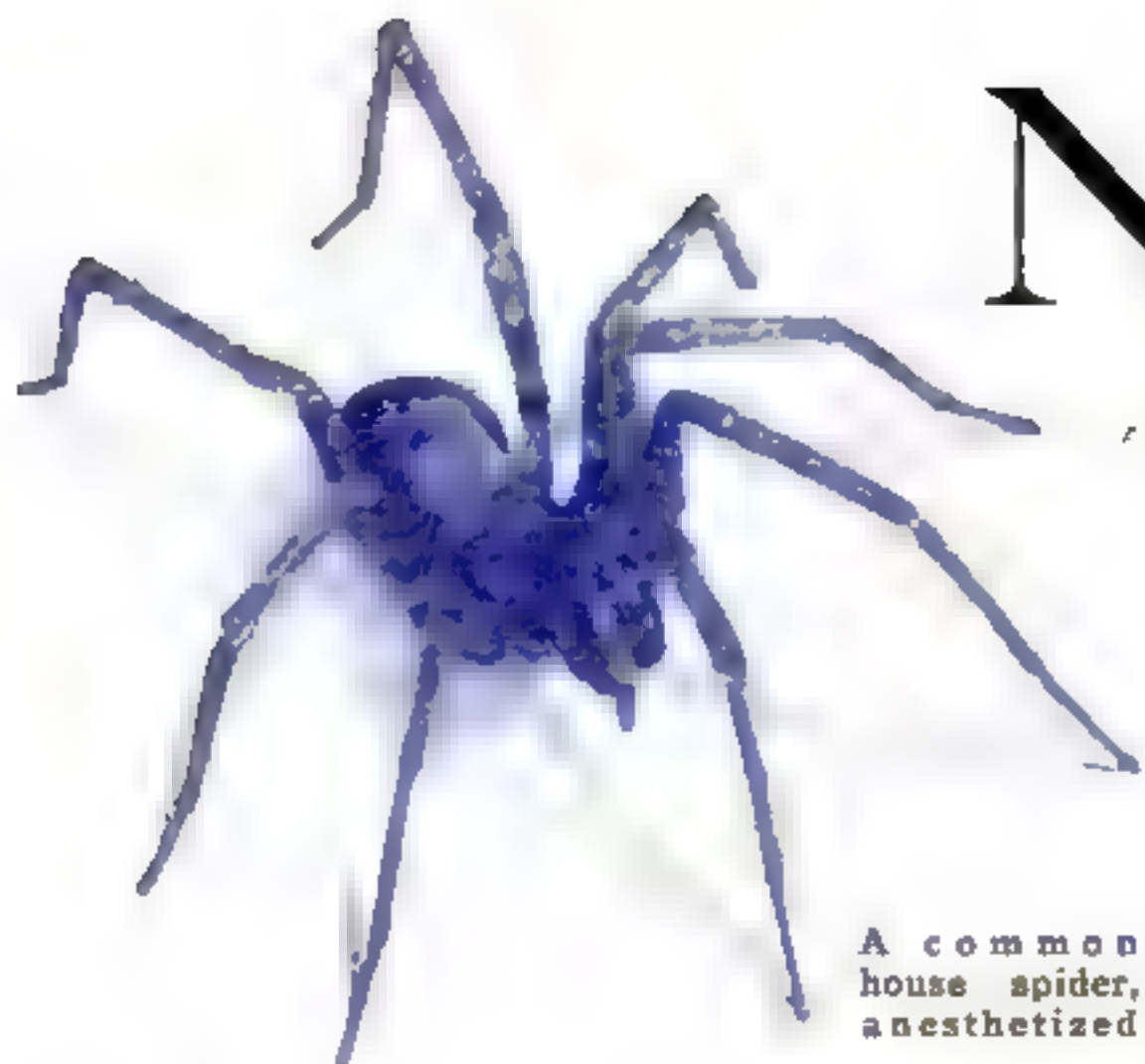
NEW BONE RACK

In addition to clamping over the edge of the plate as a repository for bones, this table accessory can be placed beside the plate to keep soiled silver off the cloth

TIMES EGGS

A timing device for boiled eggs is built into the handle of the rack illustrated at the left, which holds a half dozen eggs in boiling water





A common house spider, anesthetized

Nature's Master

Penetrating the Secrets of the World's Most Famous Weavers With the Aid of Your Lenses and Easily Made Dissecting Tools

By Morton C. Walling

TO THE housewife, cobwebs are just one more source of annoyance, but to the amateur microscopist they point the way to new and fascinating studies. For where one finds the lacy webs, one also finds spiders, whose activities as net builders are only less enthralling than the intricate structure of the creatures themselves.

We usually think of spiders as insects, but if we look at one closely, we find that it has eight walking legs, whereas true insects invariably are six-legged. Therefore, to call an eight-legged spider an insect is not strictly correct. Technically, a spider is not an insect at all; it is an arachnid.

Along with the spiders, the class of arachnids includes the mites, ticks, king (horseshoe) crabs, and scorpions. Being the most common arachnids, however, spiders usually are taken as examples of

the entire class. Among the characteristic features are the lack of antennae and of true jaws, the presence of a pair of peculiar tools and weapons called chelicerae, and division of the body into two segments, the abdomen or rear part, and the cephalothorax or anterior portion.

You should have no trouble capturing a spider or two for specimen material. The hunt is not a dangerous one, provided you avoid the shiny, dark-brown Black Widow and the hairy tarantula, which are just about the most poisonous spiders known. Other spiders may bite, if you are careless, but their bites, although poisonous to insects and small animals, will not be dangerous to you. A convenient way of capturing a spider after you have found it is to clap the open end of a test tube or bottle over it, and then carefully slide a putty-knife blade, flat steel rule, or other suitable instrument under the spider.

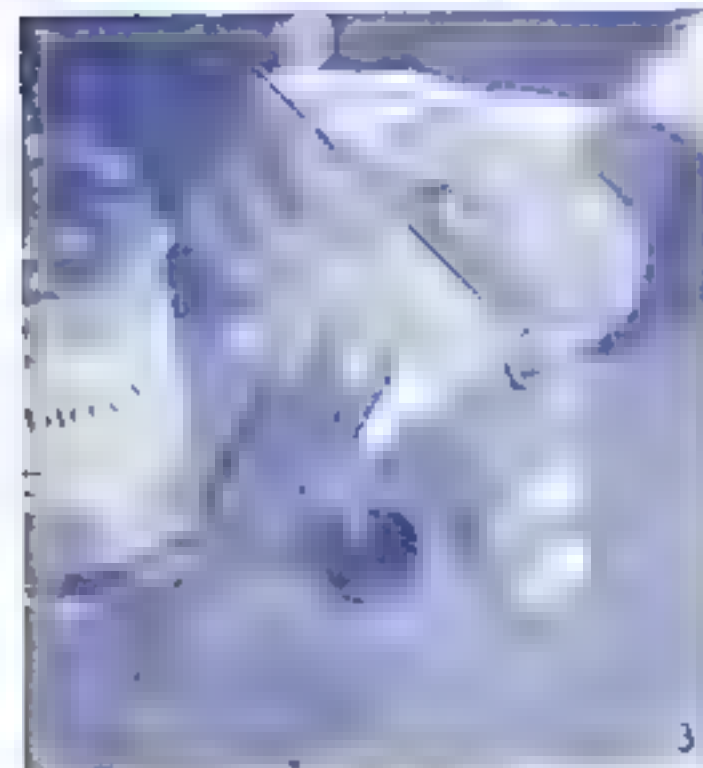
After the spider is in the tube, it is easy to cork the mouth with a wad of cotton and then place a few drops

of ether or chloroform on the cotton. Turn the tube upside down, and soon the spider will be in dreamland. Then you can pick up your captive and drop it into alcohol or a fixing solution. Of course, you can drown the spider directly in alcohol (about seventy percent ethyl alcohol of the common "rubbing" or denatured kind will do), without first anesthetizing it with ether, but it will be easier to handle when it is asleep. If you want to make a photograph of a spider so that it will appear lifelike, the ether treatment is recommended. If the subject shows signs of waking up before you are through, a drop of ether on its body will quiet it for a few more minutes.

Examine your captive under a hand lens or the lowest power of your microscope. You will find that the body is divided roughly into two halves. The cephalothorax, or fore part, serves as the point of attachment for the numerous appendages—no less than a round dozen of them, while the soft, often much larger, abdomen has an important set of appendages that cannot be seen without the aid of a lens.

Clip a leg from one of your specimens, and lay it on a slide. At a magnification of 100 to 300 diameters you can see its con-

Clipping the leg from a spider's shed skin. After soaking in xylol, the leg is mounted in balsam



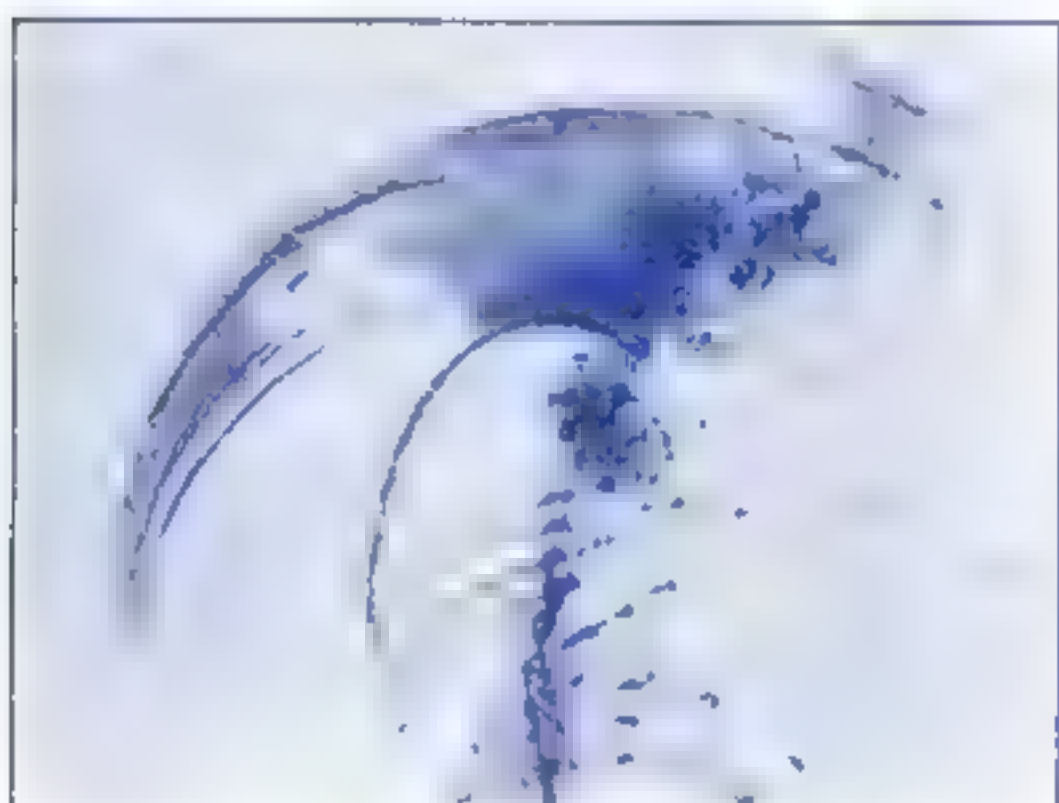
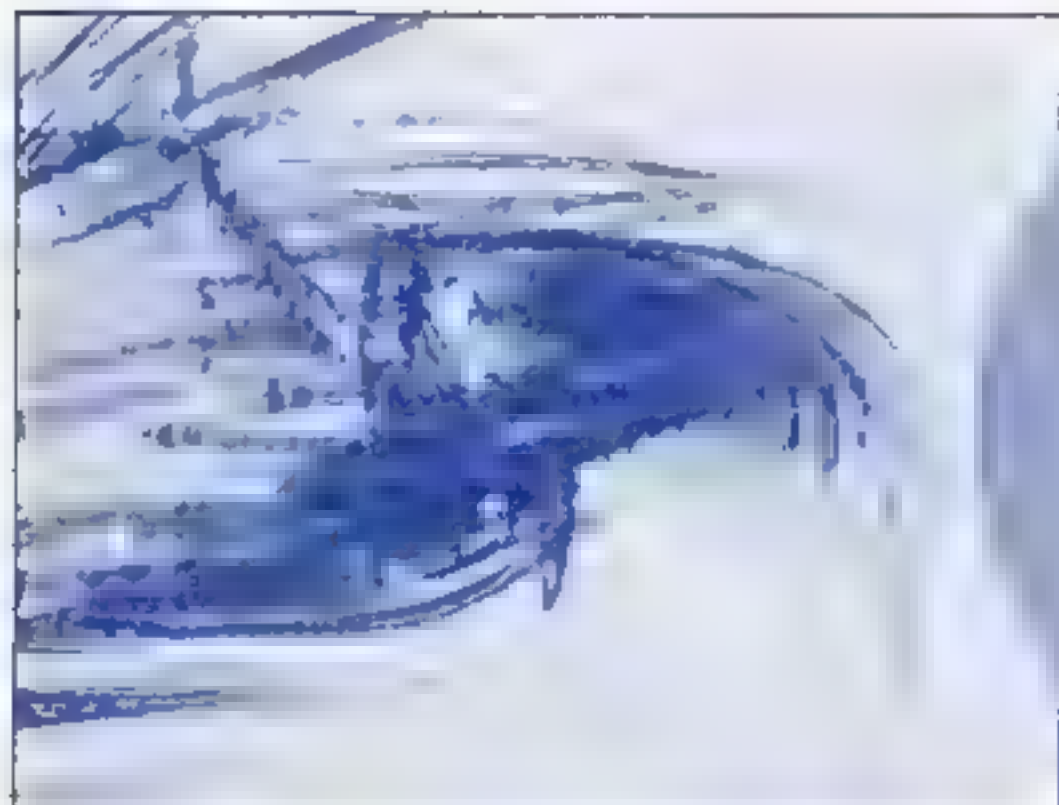
PREPARING SPECIMENS WITH DIOXAN

Spiders, imprisoned in test tubes (1), are anesthetized with a drop or two of ether, then fixed in a picric-alcohol solution (2). After fixing, the specimen may be stained, if desired. The water and alcohol are removed with dioxan and calcium chloride (3), after which the specimens are ready for mounting on a slide in balsam (4).



Builder

YOUR MICROSCOPE REVEALS WONDERS OF SPIDERS



HOW SPIDERS SNARE AND POISON THEIR INSECT PREY

Right, a perfect spider web. The radial strands are dry, but the spiral threads, above, carry beads of a sticky substance to trap insects. Upper left, the claws and teeth of a spider's foot. They aid in clinging to webs. A close-up of a spider's poison fang is shown at left



struction clearly. The segments, you will note, are covered rather plentifully with hairs, many of them branched. These, students of spider life agree, are useful in helping the spider stay on its web without falling off. Were the hairs not present, it might have difficulty in getting a foothold on the slender, silken strands. Web-walking is further aided by toothed claws at the end of each leg. There are two claws, sometimes three. Many specimens have a pair of large claws, each having fourteen teeth, arranged like those in a comb, directly behind the claw point, and between them a small, third claw, with only three teeth in its comb. These claws, like those on many insect legs, enable the spider to grip the surfaces on which it is walking, as well as to cling to its web. In addition to the claws, there frequently is a pad of hairs from which a sticky substance is secreted. This equipment makes it possible for the spider to walk on walls and ceilings.

Directly ahead of the foremost pair of legs is a pair of leglike "pedipalpi," which some observers mistake for antennae. The bases of these appendages serve as makeshift jaws, and the male spiders use their pedipalpi as sexual organs.

Finally you come to the sixth pair of appendages, those nearest the front end of the spider. They are known as chelicerae, and usually are made up of two sections—the bases or mandibles, which project downward somewhat like a snout, and the lower ends, which are the deadly claws or fangs. In the larger spiders, you can see the fangs with the aid of an ordinary hand lens.

The fang is primarily a weapon of defense and a means of obtaining food. It is remarkably like the fang of a rattlesnake,

in that it is provided with poison equipment, and folds back when not in use. Behind the spider's fangs, in the chelicerae, are poison glands which manufacture a deadly fluid that is ejected at will through tiny holes near the fang tips. With this poison the spider kills flies and other insects it is going to devour, and stuns or kills its enemies. The poison is powerful enough to injure small animals and, in the case of such creatures as the Black Widow, to cause severe illness and perhaps death to human beings.

The spider, not having any true jaws, uses its various other appendages for the purpose of crushing food. It does not eat its prey in bulk but, with the aid of the bases of the pedipalpi, and sometimes the bases of some of its legs, it crushes the body of its captive while it sucks the juices through its mouth. The stomach is designed so that it can be expanded like a rubber bulb, for drawing in the nutritive juices.

On top of the spider's head you will find its bead-like eyes, usually eight of them, clustered together. The exact pattern or arrangement of the

eyes varies a little with different species.

On the underside of the spider's abdomen you can find four or five kinds of openings. The complicated tracheal piping of insects, which carries air to all parts of their bodies, is almost entirely lacking in the spider. Instead, there are, immediately behind the slender waist connecting abdomen and cephalothorax, a pair of slits which lead into special respiratory organs or "lung books." These organs contain a number of shelflike structures through which blood flows, and against which air entering through the slits makes contact. In addition to these simple lungs, some spiders have a system of tracheae or air tubes opening near the rear end of the abdomen.

The opening leading to the sexual organs is between the lung-book slits. It is protected by a special platelike device. The anus is at the ex- *(Continued on page 111)*

GLASS SCALPELS FOR DISSECTING

A spider, mounted in wax, being dissected with sharp scalpels made from small-diameter glass tubing

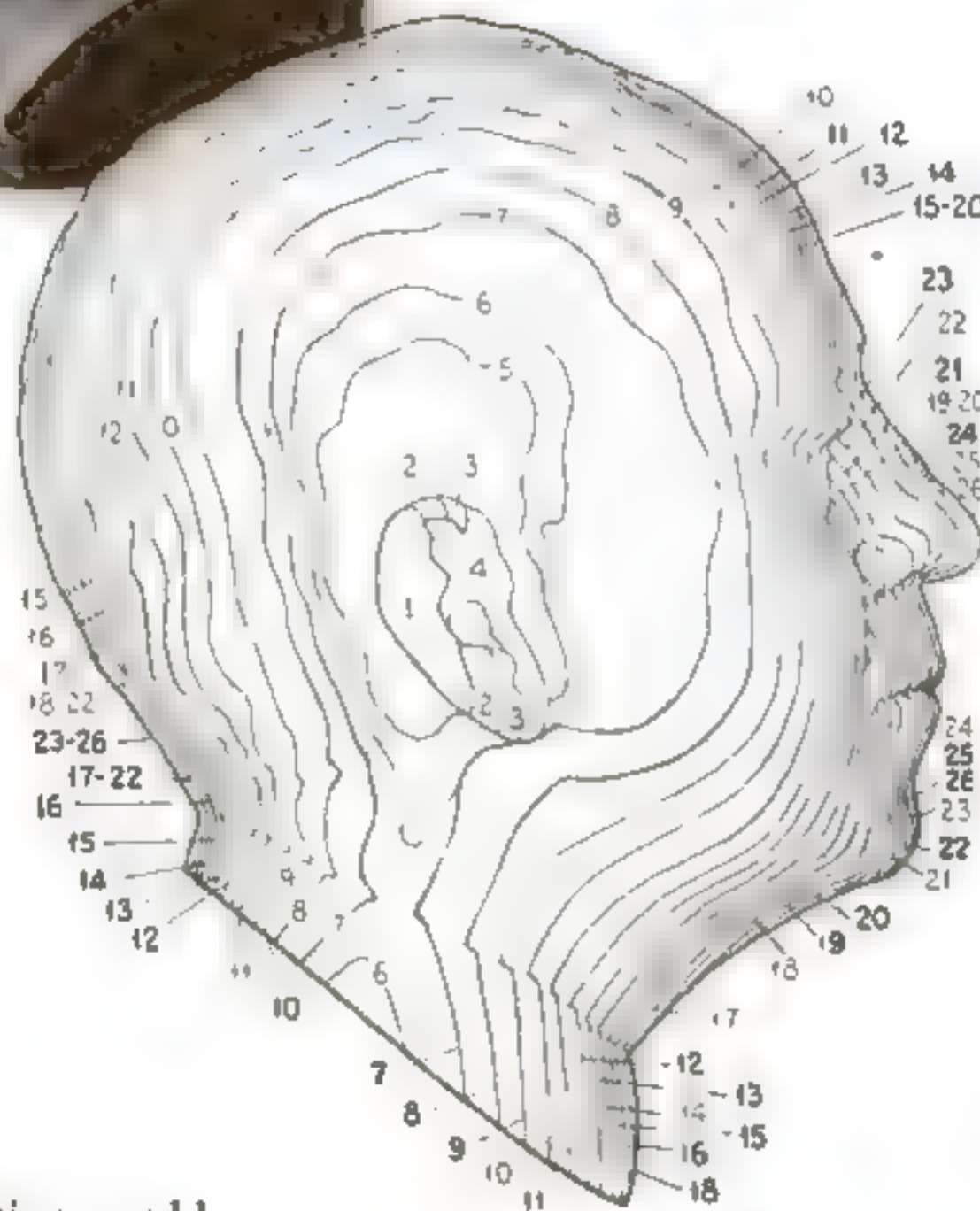


Make Lifelike Portraits of Your Friends by "CAMERA

By
**GAYLORD
JOHNSON**



The first step in the novel art process is represented by this photograph of the author, made with a simple apparatus that outlines the contours of the face and head in lights and shadows. Below is a tracing from the picture, with the contour lines all clearly marked



HERE'S a fascinating new hobby—modeling low-relief portraits of your relatives and friends for decorative wall plaques. Without any artistic training, you can produce likenesses that would do credit to a trained sculptor. All that you need is the simple apparatus illustrated in the accompanying construction diagrams and an ordinary camera.

To understand the method used in this process, imagine that you split an apple down the middle and sliced one of the halves into thin disks of uniform thickness. The first section would be a small circle, little more than the curving skin and some of the pulp. The second section would be a slightly larger disk, the third still larger, and so on. If you traced the outlines of these sections on cardboard and cut them out with scissors, you could glue the resulting cardboard disks one upon another to make a rough, flattened model of the apple. When the projecting edges of the circles were sandpapered off, you would have a true low-relief portrait of the fruit.

To apply this process to a person's head, we must accomplish a similar result by another method. The simplest way is to project the shadows of a series of straight parallel wires upon the front, back, and top of the subject's head. The shadow lines cast by the wires, following the contours of the face, hair, and neck, outline a series of sections corresponding to the slices of apple.

When the shadow-lined head is photographed from the side, and the photograph is enlarged, the outlines of all these sections can be traced off on cardboard, cut out, and built up into an accurately proportioned

relief portrait of the subject. The height of the relief depends upon the thickness of the cardboard used.

After any rough edges are sandpapered down and the resulting model smoothed up with putty or modeling clay, as described later, the relief can be cast in plaster, if desired, colored or bronzed, and used as a wall or mantel decoration.

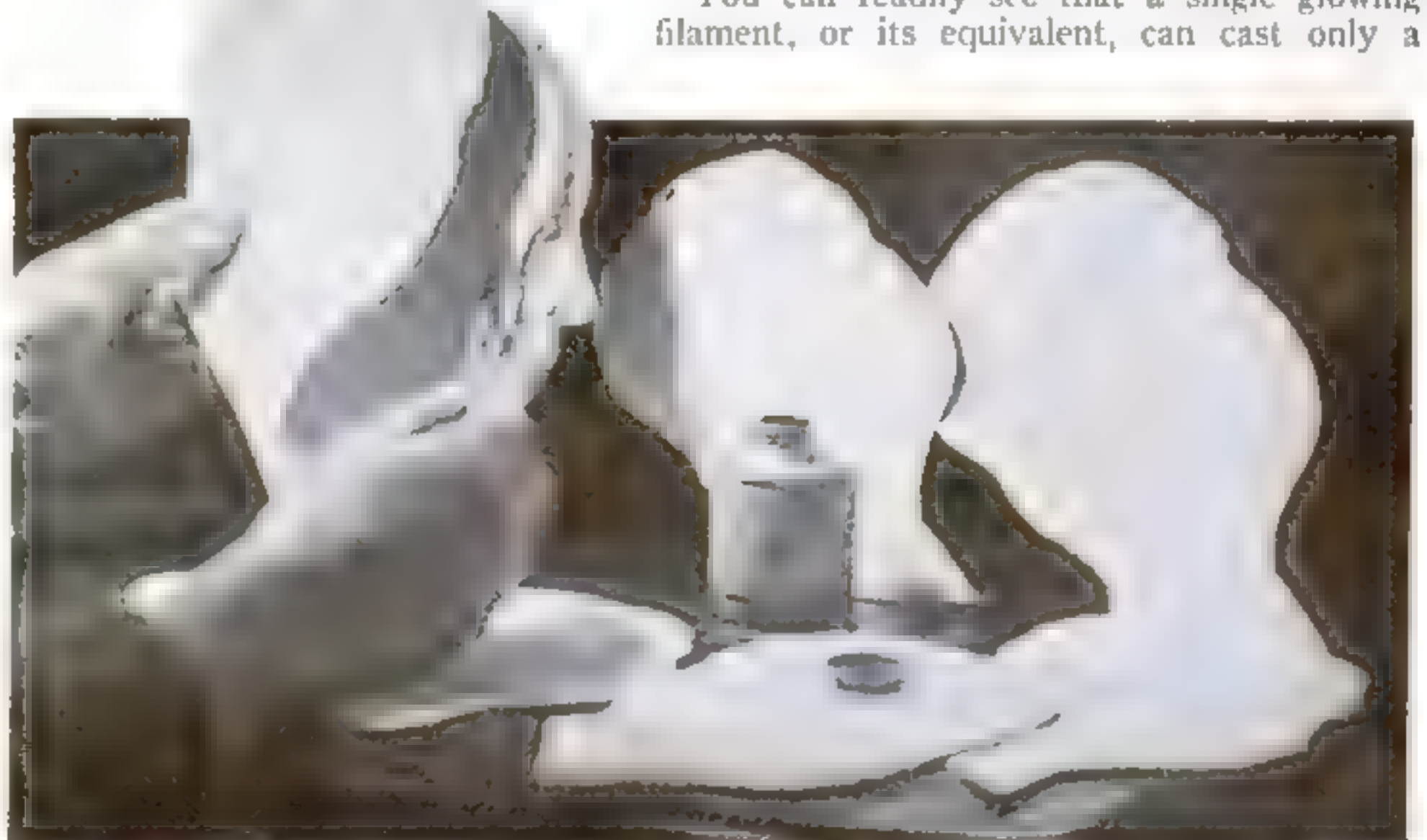
Having thus briefly summed up the method of "photo-sculpture," we will proceed to the detailed directions necessary for securing the best results. These necessarily begin with the apparatus to be constructed for obtaining the contour-lined photographs of the human subjects whose portraits you wish to make in low relief.

The scale plan will make it easy for you to build the framework which carries the lamps and wire gratings for casting the shadows. But when you look at the sieve-wire netting specified, you probably will wonder why the horizontal cross wires do not cast any contoured shadows on the face, when the vertical wires throw such distinct lines.

The secret lies in the type of clear-bulb incandescent lamp which is used on all three lamp arms. This is not an ordinary tungsten lamp with a spindle of several filaments running lengthwise of the bulb. If it were, each separate filament would cast a shadow and the result would be only confusion. Our object is to make a single sharp shadow of each vertical wire, and wipe out the shadow of each horizontal wire in the grating. The ideal lamp to accomplish this purpose would be the long, narrow, cylindrical type of bulb which has a single filament running lengthwise, but this kind is, unfortunately, not obtainable in greater strengths than forty watts, which is too weak for instantaneous photography.

Accordingly, we have to use the "type PS" lamp used commonly for store-window illumination. It is obtainable in 150 and 200-watt strength, and has its single heavy filament bent into a circle. However, when this circle is turned edgewise, it gives the same results as a lamp with a straight filament.

You can readily see that a single glowing filament, or its equivalent, can cast only a



Here the various section outlines have been transferred from the tracing and cut out of cardboard. The pieces are being glued together to build up a low-relief image of the sitter

SCULPTURE"

single, sharp shadow of a wire with which it is parallel, but will cast countless weak, practically invisible shadows of a wire to which it stands at right angles. This explains why the lamps in our apparatus must be set horizontally. This is done so that the circular filament, seen edgewise, will be parallel to the vertical wires of the sieve.

The materials used in constructing the apparatus shown in the photographs and scale plan were dowel rods and plywood, but you can use anything you have at hand. However, you should take care that the wire-screen gratings are placed exactly parallel, with each wire in the two side gratings exactly opposite to its corresponding wire on the other side. These gratings are made of galvanized screening with a mesh measuring an eighth of an inch. A mesh larger than this gives too few sections; a smaller one, too many.

These two parallel screens of mesh wire, for casting black vertical shadows, would be the only device you would ever need, provided that your subjects were all smooth-haired, blond people, or were wearing light-colored hats. But when your subject has dark hair, or wears a dark hat, you require an auxiliary screen which will cast lines that will be visible on the darker-hued surface. This requirement caused the writer a good deal of trouble, but finally was solved by a simple expedient.

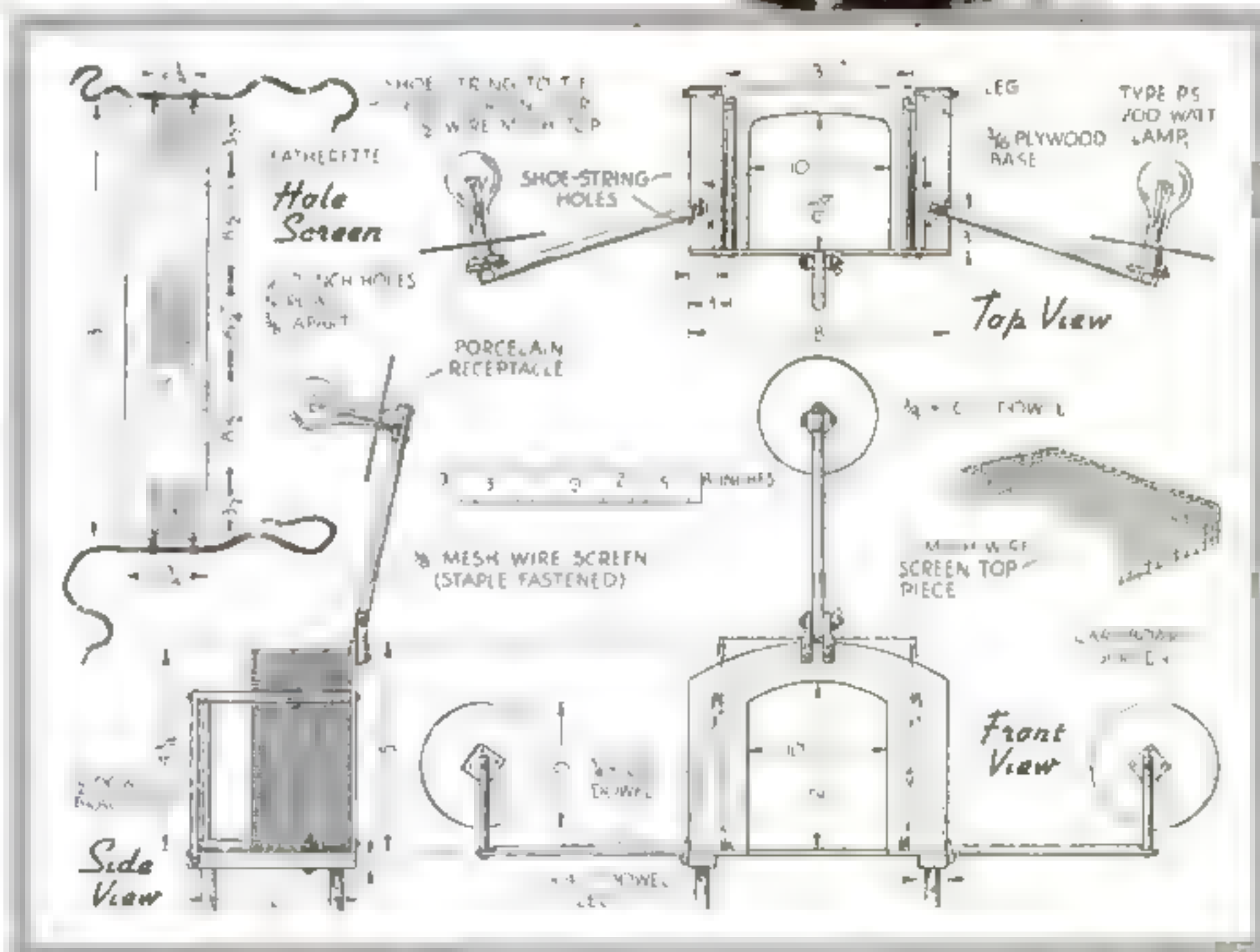
Rows of holes were cut with a sixteenth-inch punch in a strip of black paper, and the strip was placed over the top and upper sides of the apparatus. A lamp with the edgewise filament parallel to the rows of holes was then arranged to shine down upon this strip. Each hole therefore threw a "pin-hole image" of the edgewise filament upon the hair of the subject, and these images, joining up, formed a continuous, bright line which could be followed across a surface of hair that was not too irregular.

Since it would be impractical to have the rows of holes the same distance apart as the wires of the sieve screen, they have been made three times as far apart, or three eighths of an inch. This causes no trouble, as extra lines are easily put in between, when tracing the sections to be cut out and piled up, as described.

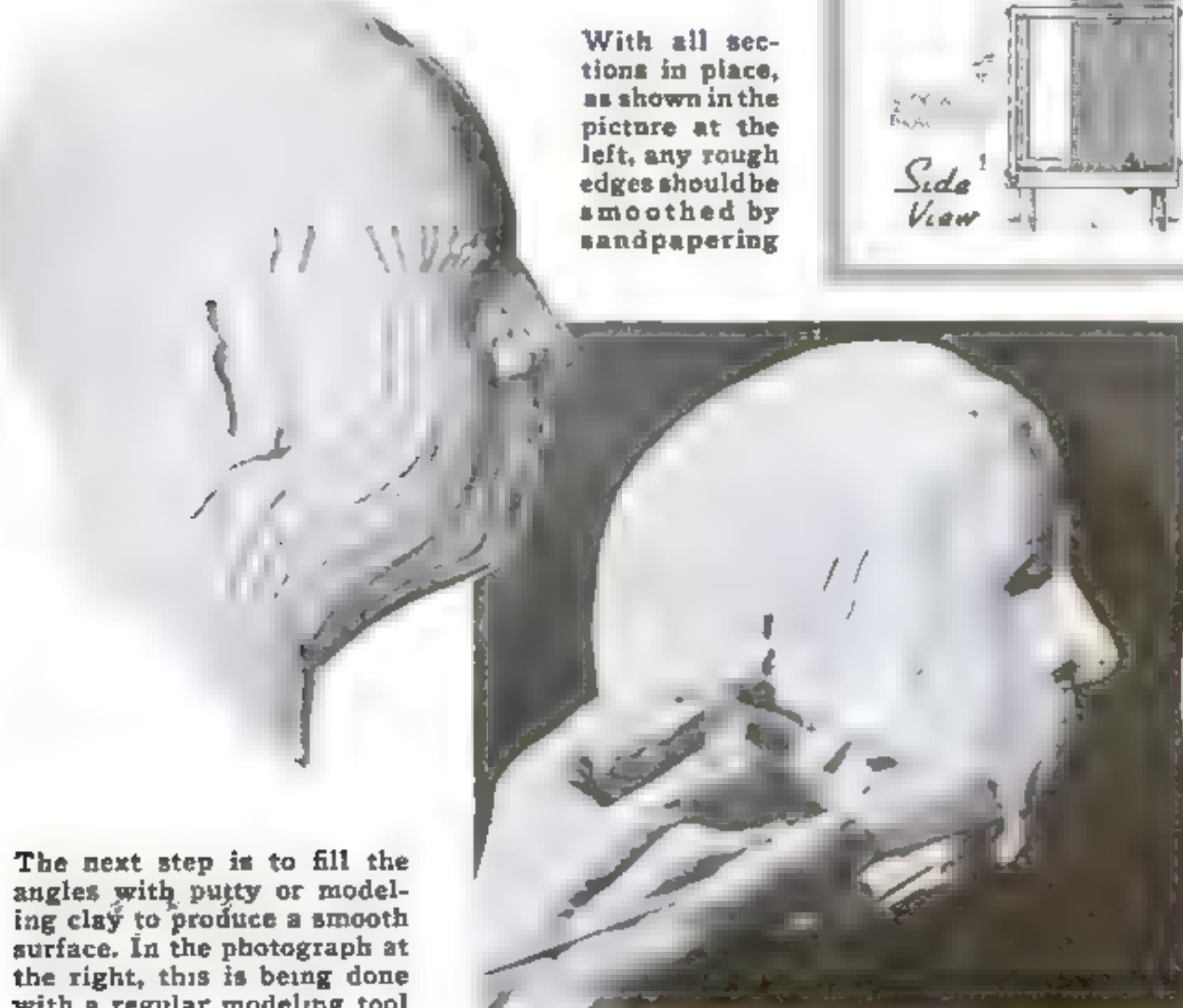
After the gratings ([Continued on page 109](#))



Apparatus set up for photographing contour lines. Wire mesh at sides casts parallel shadows, while perforated top throws lines of light on darker portions of the head



With all sections in place, as shown in the picture at the left, any rough edges should be smoothed by sandpapering



The next step is to fill the angles with putty or modeling clay to produce a smooth surface. In the photograph at the right, this is being done with a regular modeling tool

Construction details of the photographing apparatus. While dowel rods and plywood were used in the outfit described, equally good results can be secured with any other material that may be available

This is the finished plaque, mounted on its plywood base. It can be cast in plaster, with a wire loop for hanging, and painted or bronzed as desired. Duplicate casts make attractive and pleasing presents

Experiments

Show Amazing Properties



SIMPLE TEST FOR OZONE. To prove that ozone is formed by heat, blow the flame from a gas burner into a tumbler containing paper moistened with a starch-iodide solution

By
**RAYMOND B.
WAILES**

ONE of the most vivid memories of your boyhood may be of a time when a cut sent you hurrying to the medicine cabinet for the "peroxide" bottle. Perhaps you still can recall the "plop" as you withdrew the cork; the bleached stump of the stopper's inner surface; and the bubbles that gushed from the cut as the liquid met the blood. You recollect, too, that the container was always of amber or brown glass. All of these little oddities follow from the curious nature of hydrogen peroxide, the liquid in the bottle, which you can investigate in your home laboratory with interesting chemical experiments.

Hydrogen peroxide's outstanding trait is its readiness to decompose into water and oxygen gas. An atom of oxygen gas, which, combined with a molecule of water, forms the hydrogen peroxide molecule, is constantly trying to escape. Even in weak solutions, it succeeds quite well. When you uncork the peroxide bottle, you release pent-up oxygen gas that has escaped from the liquid, and this accounts for the plopping noise that you hear.

The hydrogen peroxide that you can obtain at any drug store will serve nicely for chemical tests. This is a three-percent solution, and is often called "ten-volume peroxide," meaning that one part by volume of hydrogen peroxide will yield ten parts by volume of oxygen gas.

To keep the commercial solution from decomposing spontaneously into water and oxygen, a trace of acid or of an organic substance such as acetanilide is added. An



DECOMPOSING PEROXIDE
Heated with an alkali, hydrogen peroxide will break down and release oxygen, but alone or with an acid, it remains unchanged, as litmus-paper strips will show

alkali would have the opposite effect, aiding the peroxide to decompose. To show this, place a little of the drug-store peroxide solution and a piece of blue litmus paper in each of three test tubes. Add a drop of some acid to one tube, a bit of lye or other caustic to another, and nothing to the remaining test tube. Set the test tubes in a beaker of boiling water. Soon you will notice bubbles of oxygen gas rising from the alkali-treated solution, which is marked by the litmus strip that remains blue, as the hydrogen peroxide decomposes. After a time, the oxygen will bleach the litmus paper practically colorless. In neither of the other tubes is the hydrogen peroxide affected.

Drop the business end of a "magic" or "strikeless" kitchen gas lighter into a beaker holding an ounce or so of peroxide. Oxygen instantly streams from the lit-

tle black blob of spongy rare metal in the lighter. The "catalyst," or active part of the lighter, promotes the spontaneous decomposition of the hydrogen peroxide, and the resulting gas will continue forming for hours.

When you need a small quantity of oxygen gas for home experiments, you can make it neatly and conveniently from hydrogen peroxide. Simply place a warm solution of lye or another alkali in a gas-generating flask such as the one described last month (P.S.M., May '37, p. 68), and admit hydrogen peroxide drop by drop through a separatory funnel. You also can use manganese dioxide, bone black, or potassium permanganate crystals in the flask, instead of the alkali.

Worth a place in any group of home-magic tricks is a pretty little experiment that you can perform with hydrogen peroxide. First, you exhibit a blank sheet of black paper. Then, dipping a paint brush in what appears to be water, you write upon the sheet. The writing magically appears in white letters. There is no waiting for the characters to "come up;" they appear at once.

To prepare the paper, immerse a sheet of ordinary white, semiglazed stock in a solution of lead acetate or lead nitrate. While the paper is still wet, hold it in a stream of hydrogen sulphide gas, which you can make by allowing weak acid to react with iron sulphide. This operation should be performed outdoors; any amateur chemist familiar with the odor of hydrogen sulphide will understand why. The hy-

**OXYGEN IS RELEASED
BY A CATALYST**

Lowering a kitchen gas lighter of the "sparkless" type into a beaker of hydrogen peroxide releases oxygen. The catalytic agent in the lighter serves to promote the decomposition



"Magic writing" appears when a brush dipped in hydrogen peroxide is used on paper treated with lead acetate solution

with OXYGEN

of Hydrogen Peroxide and Ozone

drogen sulphide gas converts the chemical on the paper into lead sulphide, and when the paper is dried it will be black or very dark gray. To write upon it, use an ordinary solution of hydrogen peroxide. The black lead sulphide on the paper is oxidized to white lead sulphate by the peroxide.

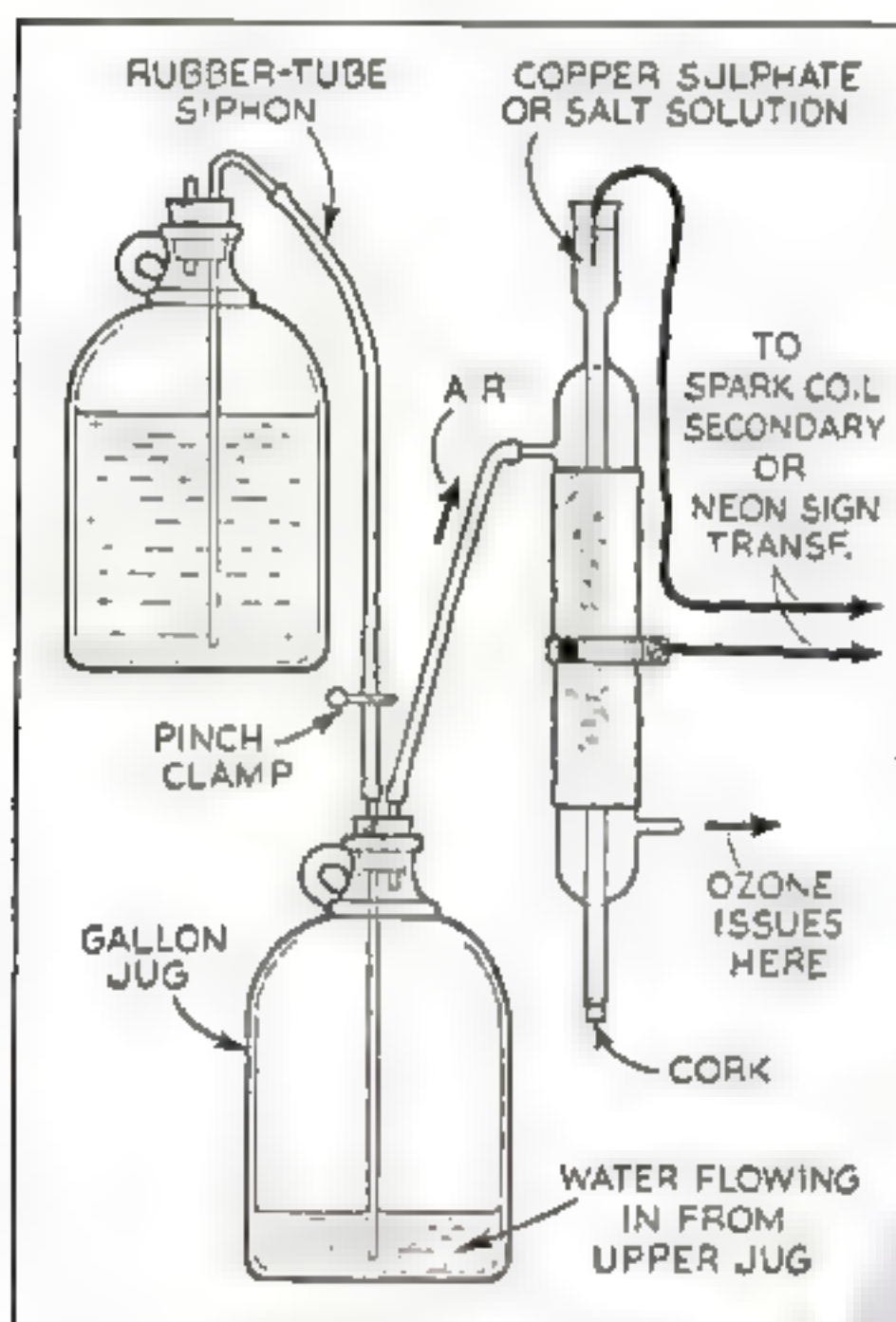
Scorched spots often can be removed from white fabrics by a similar reaction. If you apply hydrogen peroxide to the spot, the charred fibers will be oxidized or bleached colorless.

You can manufacture hydrogen peroxide in your own laboratory by adding about seventy-five cubic centimeters of barium dioxide to an ice-packed flask holding 200 cubic centimeters of cold water. (An ordinary drinking glass holds about 240 cubic centimeters.) After several hours you will

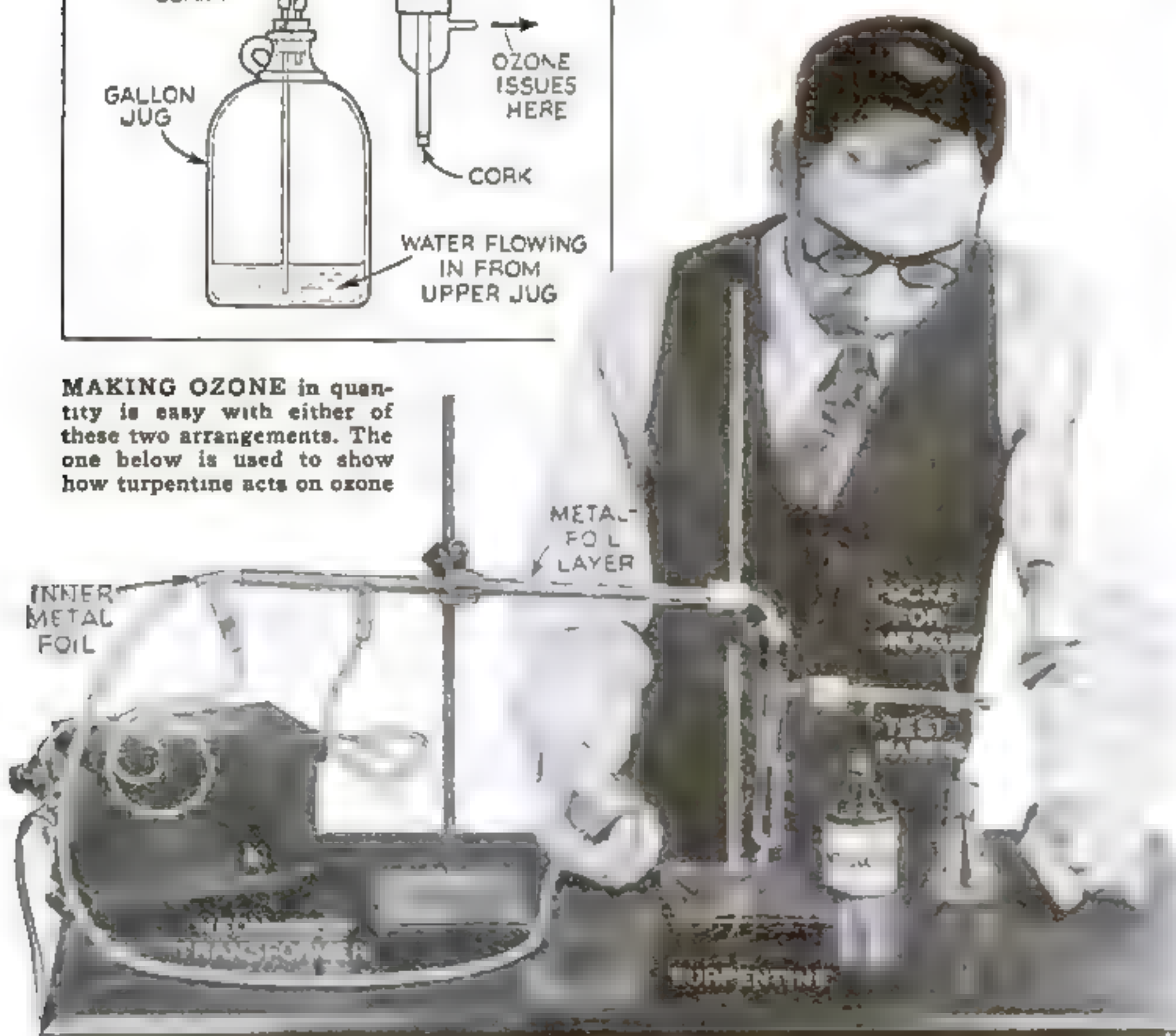
have a preparation known as hydrated barium dioxide. Now add enough strong (sirupy) phosphoric acid to the solution to give a red color to a piece of litmus paper immersed in it. As more of the barium dioxide dissolves and makes the solution alkaline again, add more acid, shaking the flask each time, until you have used, in all, about twenty cubic centimeters of phosphoric acid. During this entire operation the liquid in the flask must be kept cold—that is, at a temperature of about ten degrees centigrade, or fifty degrees Fahrenheit.

Allow the whole mixture to settle and pour off the clear upper liquid, which contains hydrogen peroxide and some barium compound in solution. Filter the clear liquid, and then add dilute sulphuric acid to it, to precipitate the soluble barium compound. Let the precipitate settle. Add a little more of the weak sulphuric acid. If more white precipitate forms, not all of the barium compound has been removed. Let the precipitate settle again, and add more acid, repeating the process until no further

OZONE IN SPARKS
That electric sparks generate ozone can be shown by holding a test paper near the brushes of a motor



MAKING OZONE in quantity is easy with either of these two arrangements. The one below is used to show how turpentine acts on ozone



precipitate occurs. Then add five or ten grams of starch to the liquid, shake it, and filter it.

The filtrate will be a strong solution of hydrogen peroxide. It can be substituted for drug-store peroxide in the tests just described. Better not try to keep it, however; peroxide of this strength, even with a preservative like acetanilide, might blow apart a tightly stoppered bottle.

A good chemical test for the presence of hydrogen peroxide can be made by dipping a strip of filter paper or ordinary white paper into a solution of potassium dichromate, which has been made acid with a drop or two of strong sulphuric acid to every ten cubic centimeters of solution. If the yellowed paper, while still wet, is touched with a solution containing hydrogen peroxide, it will turn blue.

Hydrogen peroxide is not the only substance that yields oxygen when it decomposes. Another is the peculiar gas called ozone. Two oxygen atoms make a molecule of ordinary oxygen gas; three oxygen atoms, a molecule of ozone. Thus you might consider them simply as two varieties of the same substance. But ozone exhibits interesting properties that ordinary oxygen, into which it readily turns, does not share.

Many people mistakenly believe that the air at the seashore owes its bracing, tingling aroma to ozone. Actually, it gets its peculiar tang from the decomposition of marine life. If you want to find out what ozone really smells like, you can do so right at home. All you need is some electrical appliance that uses a brush-type motor, such as a vacuum cleaner, electric fan, or electric mixer. Loosen one of the brushes so that the motor sparks brilliantly while it is running, and you can easily detect the odor of ozone, sometimes as far as several (Continued on page 125)

Novel Tests of Nature's Laws



Breathing on Glass Shows Up Invisible "Mystery Writing"

HERE is a mystifying stunt to show your friends. Write on a window glass with a piece of lead or solder, using medium pressure. No marks will be seen, and you may even rub the window with a cloth to show that nothing remains. However, if you breathe on the glass, the writing will appear in the mist with surprising clearness. It disappears as the moisture evaporates, but returns if you breathe on it again. To remove the "mystery writing," use cleaning powder.

Water Shows How Big Guns Are Aimed

PRINCIPLES of artillery fire can be demonstrated with a rubber tube attached to a faucet, as the stream of water follows a path similar to that of a giant shell. Tests will show that maximum range is obtained when the nozzle has an elevation of forty-five degrees. In actual gunfire, however, the angle of maximum range may be lower because of air resistance.

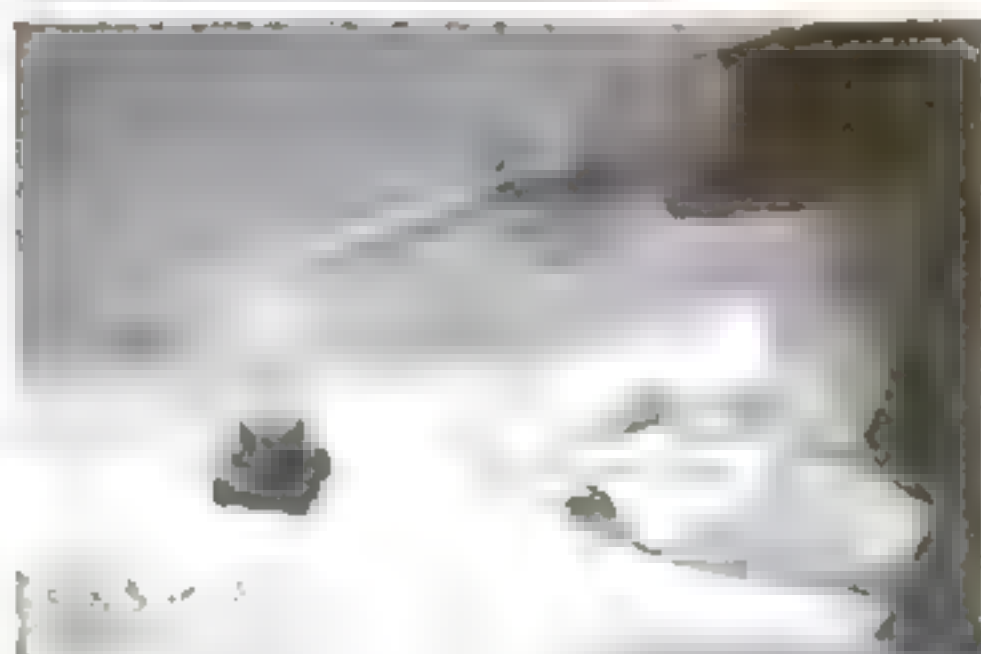


Weights Demonstrate Physical Paradox

UNDER certain conditions, the pull of two weights is no greater than that of one. Allow a weight to stretch a rubber band by means of a cord passing over a pulley, as shown at the left of the photograph. Then attach an equal weight to the other end of the rubber band. Although both weights now will be pulling on the band, it will stretch no more than before. The reason is that one weight merely replaces the finger to hold the other.

Frictional Electricity Lights Neon Bulb

RUB a warm, dry glass tube, or a glass towel rod, with a piece of silken or woolen cloth. Touch the glass of a neon tube with the rod, as seen at the right. Part of the bulb and its plates will glow, the strength of the light depending on the amount of the electric charge.



Simple Experiment Illustrates Principle of Telescope

THE working of a telescope can be explained with the apparatus pictured below. The inverted image of a cardboard arrow attached to a light bulb is thrown on a piece of waxed paper by an "objective" lens and is magnified by an "eye-piece" lens which turns it right side up again. In a real telescope, however, there is no screen.



Pendulum Measures Gravity Variations

How a pendulum can be used to measure variations in the pull of gravity is shown by the simple experiment illustrated at the left. First, time the free pendulum for a number of swings. Then attach a rubber band to the weight and hold it so as to make a slight tension. The rate of oscillation is increased, just as it would be if the pull of gravity became greater.



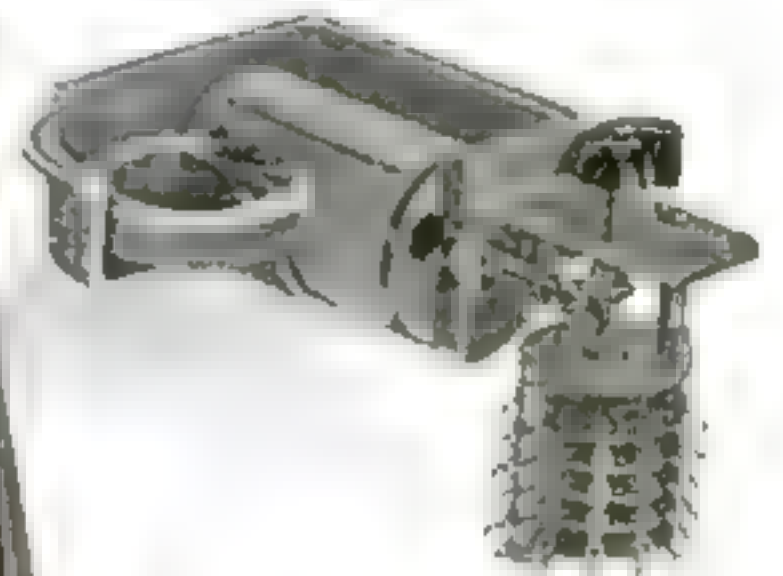
SIX NEW HELPS FOR Radio Builders

Vibrationproof Desk Houses Short-Wave Set

TO PROVIDE the best in tone and quality, a radio desk manufactured to house a commercial short-wave receiver is acoustically designed to eliminate bothersome vibrations. Heavy shatterproof glass, set in special sponge-rubber mount-

ings, is used in the doors at the top of the cabinet to prevent rattling. The speaker compartment is completely lined with insulating material to eliminate any possibility of "booming" or "rumbling"; while the heavy wooden parts are assembled with tongue-and-groove joints.

All-Purpose Meter Has Twelve Separate Scales



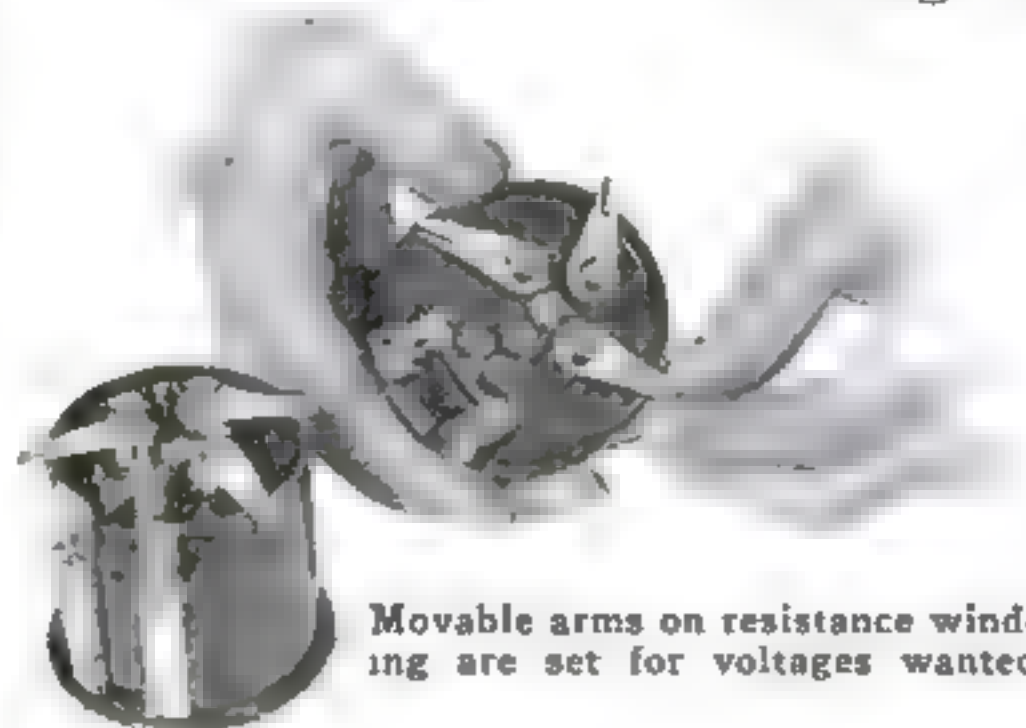
The rotating drum indicator above enables this instrument to be used as an ohmmeter, ammeter, or voltmeter as desired scale is selected

when the unit is to be used for making various types of measurements. Adjusting the selector knob turns the drum to

the desired scale and automatically switches in the proper circuit to transform the meter into an ohmmeter, an ammeter, or a voltmeter, as the case may be. As many as twelve separate scales can be used.

Voltage Dividers Are Easily Set

RESEMBLING large rheostats, voltage dividers of a new design can be adjusted quickly to give the desired voltages. Particularly suited to experimental work and set building, the variable units consist of a wire resistance and three movable arms, each of which covers one third of the winding. They are easily mounted on a panel or a baseboard and can be obtained in a wide variety of sizes with resistances ranging from 5,000 to 200,000 ohms.

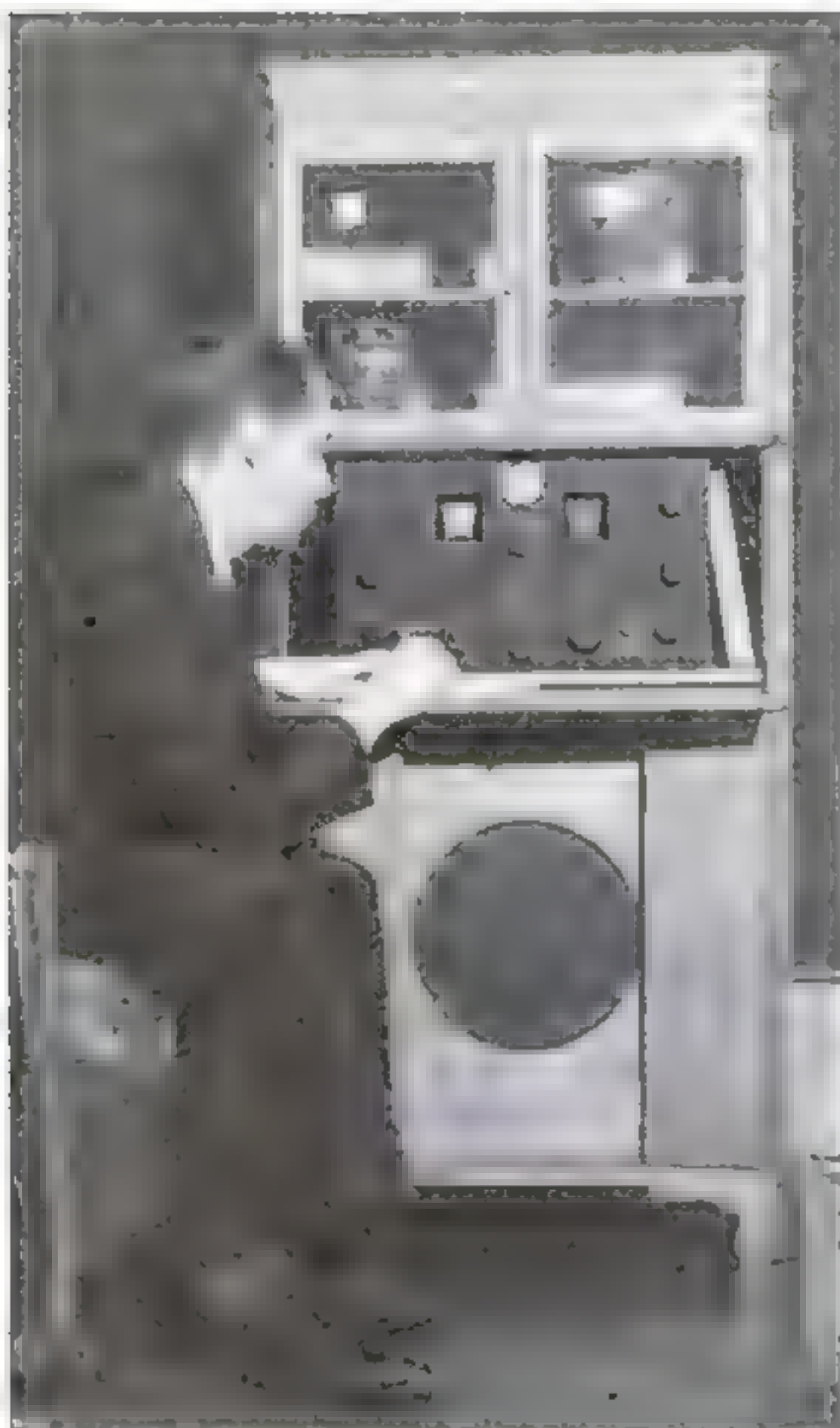


Movable arms on resistance winding are set for voltages wanted

Cork Washers Save Insulators from Breaking

FEED-THROUGH and stand-off insulators have an annoying habit of cracking when the mounting screws are turned up too tight. This trouble can be prevented by padding the base of the insulator with a cork washer trimmed to shape from a thin slice cut from a large bottle stopper. The washers will not only prevent initial breakage, but will protect the insulators from strains due to expansion and contraction.

How washers are made from slices cut off large-size bottle corks



Specially constructed desk for a commercial receiver

Tiny Microphone Is Streamline



A dynamic microphone for amateurs

SMALL enough to be held in the hand, and weighing only a pound and a half, a new dynamic microphone now on the market is designed to fill the needs of the radio amateur. Low in cost, the streamline unit requires no power supply and is not affected by weather conditions. It can be used efficiently as far as 1,000 feet from the amplifier.

Plug-In Resistors Fit Ordinary Tube Socket

BY USING new-type plug-in resistors, radio experimenters can easily construct test circuits and Wheatstone bridges. Consisting of wire-wound forms in four-prong bases, the units are plugged into tube sockets to connect them into the circuit. Odd resistance values are obtained by changes in wiring the sockets.

New-type resistors adaptable for many uses



Homemade Pocket



This tiny portable can be slipped into a pocket

By H. M. GREGORY

DESIGNED especially for the set builder who wants a really compact receiver, this three-tube portable outfit is so small that it can be easily carried in your coat pocket. Complete with its built-in battery supply, the tiny midget is little larger than a box of kitchen matches; yet it provides clear earphone reception on the entire broadcast band.

The circuit, simplicity itself, is the result of several years of experimenting to obtain the irreducible minimum in size and weight without sacrificing efficiency. Through careful selection of the parts, it provides excellent sensitivity, selectivity, volume, and tone—and, last but not least, it is easy on batteries.

Before going further, however, it will be

best to describe the one development which has made the extreme compactness of this set possible—the tiny tubes. These are of English make, but can be purchased easily in this country. There is nothing resembling them in the catalogues of American tube manufacturers. The so-called “acorn” tubes are small, but they are designed for an entirely different purpose, and one “acorn” tube uses over three times the filament power required by all three of the tubes in this portable set.

In spite of their size, however, the tiny units are quite similar in electrical characteristics to some of the standard American battery-type tubes. The type XSG, for instance, is quite like the 32, the XL is similar to the 30, and the XY is very much like the 1F4.

All other components in the circuit also were chosen for their compactness and ease of mounting. For the variable tuning condenser (C₁), another product of English manufacture is used. The midget condenser is of the composition-dielectric type. That is, instead of having the plates carefully positioned

with air as the insulating medium, they are insulated by thin fiber sheets. This type of construction makes it possible to cram a large capacity into a relatively small space. These also can be obtained from most large radio parts supply companies.

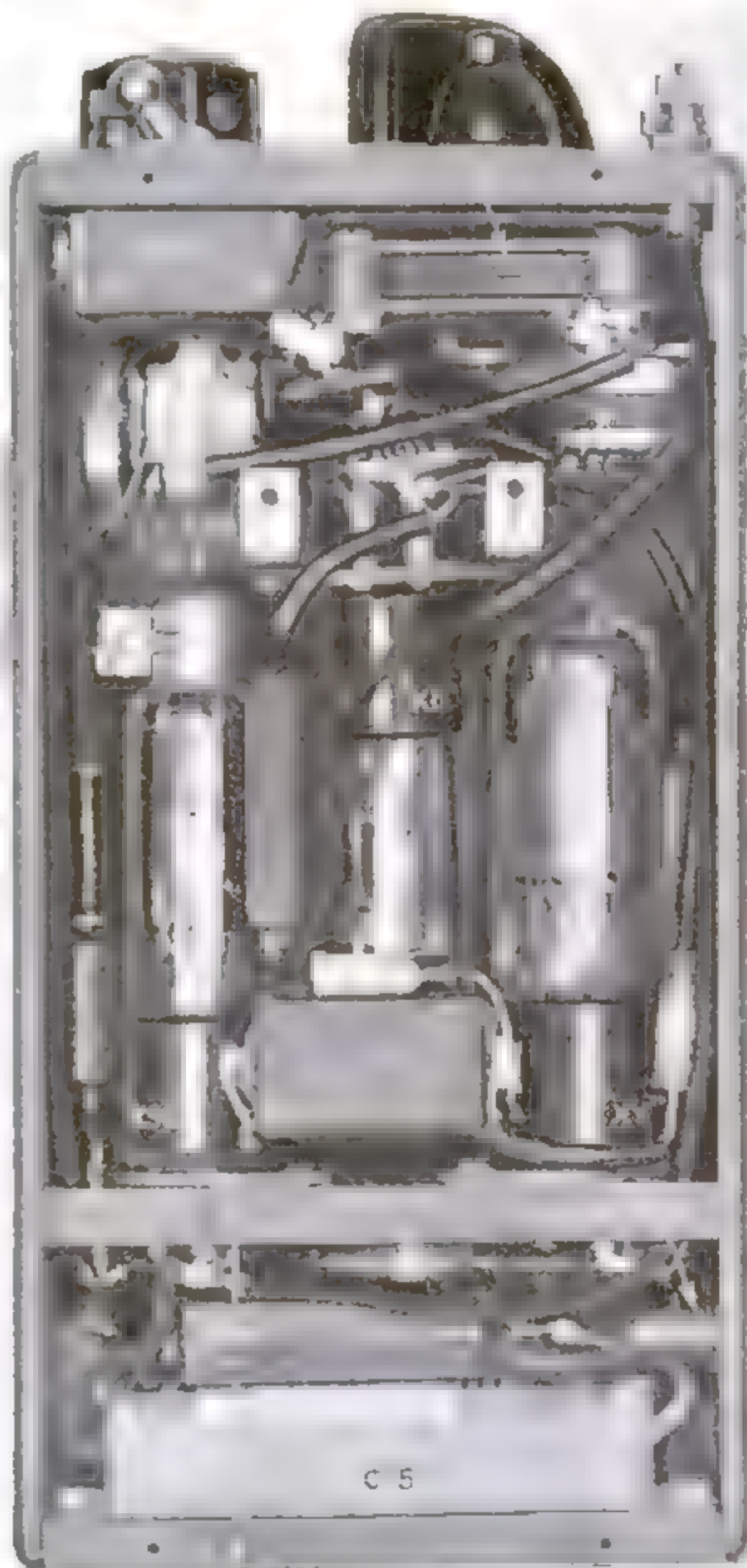
The condensers, as purchased, have a capacity of about 250 micromicrofarads. As this is rather low for our standard coil ranges, one rotor plate and one stator plate from another condenser of the same type should be added to the unit for best results. This will raise the capacity sufficiently to cover a much larger portion of the broadcast band. Of course, the condenser can be used as it comes, but then it will cover only about two-thirds of the band.

The tuning coil (L₁ and L₂) is of the new iron-core type. It must be removed from its shield can, all leads detached from the terminal plate, and about half of the turns on the primary coil (L₁) removed. This winding is used as the tickler in the receiver circuit and is wound



A COMPACT RECEIVER

One of the wee English-made tubes is shown above in comparison with an ordinary tube. Right, the set with a side removed and, below, in use. Batteries are inside



Radio USES MIDGET TUBES AND PARTS

with fine wire. The secondary (L_2) is wound with multistrand wire, and should not be altered. For compactness, the form on which the coils are wound should be cut off to within one eighth inch of the lower end of the tickler winding. The complete coil can be fastened to the side of the cabinet with a single wood screw.

Because of the low power needed, one portable forty-five-volt "B" unit and a single flash-light cell serve as the complete battery supply. The forty-five-volt "B" battery can be connected into the circuit by flexible leads, while the "A" battery slides into place, contact being made automatically by spring clips built into each end of the battery compartment, as shown in one of the photographs.

Although the tubes are designed to work on a two-volt filament voltage, they will operate with little loss in efficiency on the single one and one-half-volt cell. By using only a single cell, the battery life is greatly increased, since at one and one half volts the total current drain of the three

tubes is only 150 milliamperes, instead of the 240 milliamperes required if the tubes are run at rated voltage.

Although almost any material could be used for the case, I found that pressed composition wood sheeting was both durable and easy to work. The ends are one quarter inch thick, while the sides are of one-eighth-inch stock. When all pieces have been cut to size, fasten the two smaller sides permanently to the ends. Each corner can be held in place by two one-quarter-inch, flat-head, brass screws. The holes for these must be carefully made in the end pieces to avoid splitting. Clamp the piece at the edge, where the hole is to be made, with a small "C" clamp, or grip the stock in a vise. Make the hole with a drill a few sizes smaller than the screw, and then run the screws in. This will form a neat thread. When all holes are thus prepared, smear the edges well with cement, and fasten the four pieces together. Allow at least two hours for drying.

Since the large sides must be removable,

they are not glued in, but are held by two screws at each end; the screw holes being made as described above.

In mounting the various parts, take your time and use the accompanying photographs to guide you. The XSG and XY tube sockets are mounted on a $\frac{1}{4}$ by $\frac{7}{8}$ by 3-inch piece of wood, which is glued in place. The XL socket mounts on brackets which fasten to one of the large sides. To save space the sockets should be filed down to a width of three quarters of an inch.

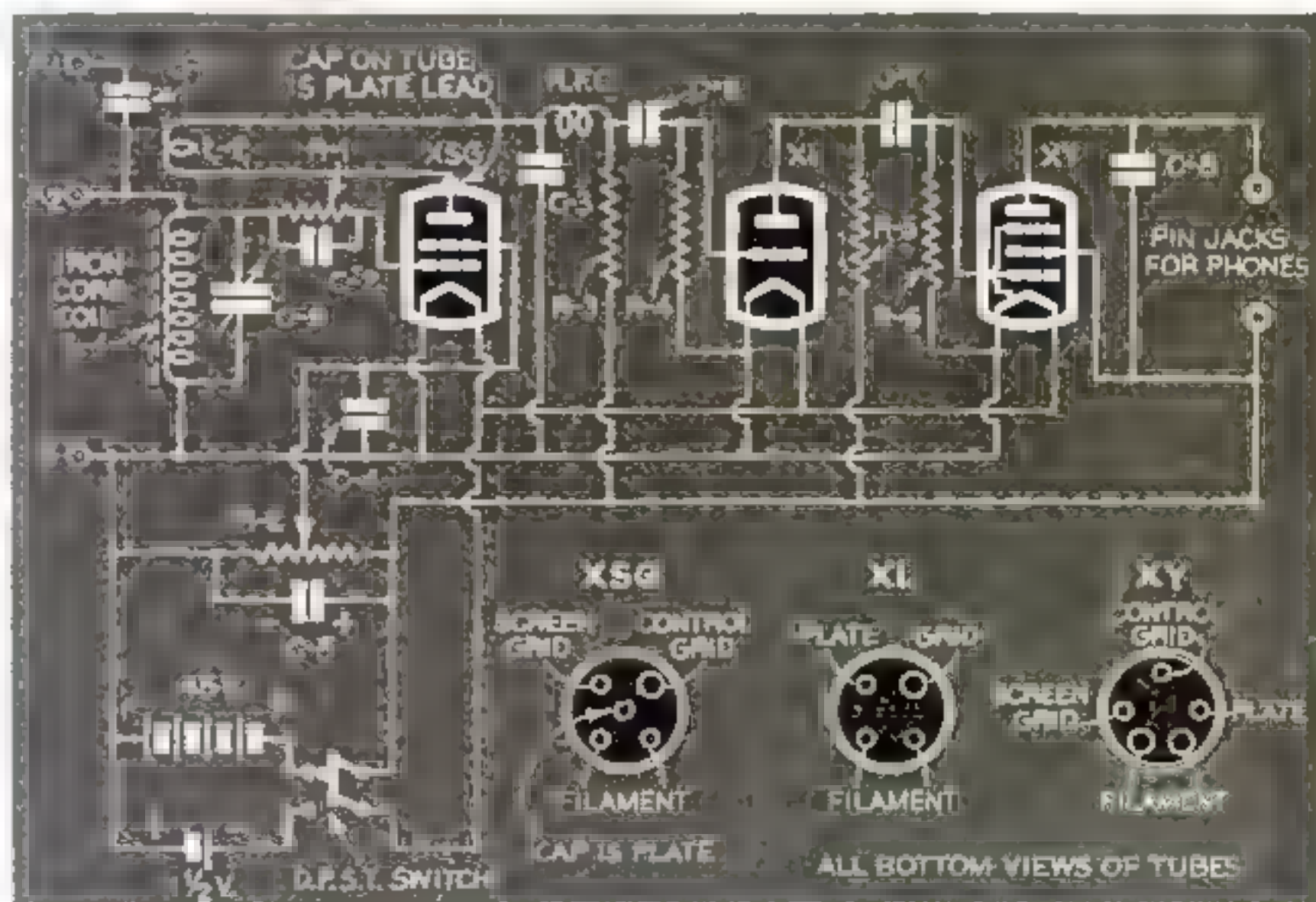
When all parts have been fitted and all holes have been drilled, the parts should be removed and the cabinet assembled for the final outside finish. The surface and edges should be carefully smoothed with fine sandpaper. Before this is done, however, it is a good idea to cover the screw holes with a filling of glue and fine wood dust. The edges of the cabinet should be rounded slightly for better appearance. After a thorough sanding, apply a coat of clear lacquer and allow it to dry. Sand this coat with very fine paper and lacquer again.

Allow the second coat to dry thoroughly. Then after a sanding with fine paper, rub it well with powdered pumice on a wet cloth. Finally, wash off the pumice, dry, and apply several well-rubbed coats of ordinary automobile wax. The result will be a beautiful dull gloss, a finish which is very tough and wear-resistant.

When the cabinet is completely finished, the final assembly and wiring can be started. As shown in the diagram, an electrolytic condenser (C_2) is connected from the positive "B" lead to ground. This connection would not be necessary if the "B" battery would always remain new and fresh. When the battery gets old, however, its internal resistance increases and, although the voltage may be high enough to oper- *(Continued on page 120)*



HERE IS REAL RADIO PORTABILITY
The complete outfit can be held in one hand, as shown. The lightweight battery supply is seen in the illustration at extreme left. Diagram below gives details of the circuit



Gus turned a valve on the tester and, as the pressure inside the case went up, Nolan saw the heavy, red spark on the points of the spark plug fade to a thin, bluish line



*Gus
gives some*

Up-to-Date Ignition Tests

TOM NOLAN scratched the end of his long, thin nose with a grimy finger as he glared witheringly at the motor of his new sedan.

"You're a fine-looking job, old girl," he grumbled disgustedly, "but when it comes to running, you're almost as rotten as that crate I got stuck with back in 1924. Every time I get you on a stiff hill, you go temperamental on me and stutter and skip like nobody's business! I wish I could find out what is the matter with your innards."

The elderly motorist walked around to the other side of the car and eyed each part of the motor that was visible from that point.

"The trouble can't be in your fuel system," he reasoned. "There's not a speck of dirt or water in that carburetor. And your ignition system seems perfect—I've tested the spark plugs, there's an almighty juicy spark, and your contact points are only a little burned."

"Guess I'd better test those plugs again," he muttered. "Maybe I missed one the last time."

After starting the motor and letting it idle a moment or two until it settled down to steady running, he fished a wooden-handled screw driver out of his tool kit and pressed the blade against each cylinder in turn, in such a position that the shaft of the screw-driver blade was a little less than a quarter of an inch from the plug connection. From each plug a snappy blue spark flecked with red crackled regularly to the steel shaft. Each time this happened, the smooth running of the

motor was broken by a slight jerk. As near as Nolan could judge, the effect was the same for each cylinder.

"Every one as right as rain," he grumbled, as he tossed the screw driver back into the tool kit. "Guess I'll take you down to Gus. Maybe you've got some queer disease that'll stump him, too."

Nolan backed the sedan out into the street and, a few minutes later, pulled up in front of the Model Garage. Gus Wilson, half owner and the mechanic of the establishment, put down the padded hammer he was using to repair a fender.

"Howdy, Tom," he greeted the newcomer. "Trouble with the new bus?"

"She's got something mighty mysterious the matter with her," Nolan replied, detailing the symptoms and the tests he had made. "And I'll bet it's something that'll fool you, too."

"That wouldn't be any wonder," laughed Gus. "The man isn't born yet who can't be fooled about car troubles. Motor misses under load, does it? Most likely the trouble's in the spark plugs, so we'll start there."

"But didn't you hear me say I'd just tested them?" Nolan protested indignantly. "Don't you think I know how to test spark plugs?"

"You did, back in the dark ages of automobiles, Tom," Gus grinned, as he removed the spark-plug wires and fished out the proper socket wrench. "But that old screw-driver test only tells you whether the plugs are badly fouled or not, and

cars nowadays don't foul plugs much until they get old and start to pump oil.

"The only test that shows anything about spark plugs now," Gus continued, as he removed the last plug and started into the garage with Nolan following him, "is to see how they spark under compression. All the modern cars have such high compression, compared to the old-timers, that the plugs are up against a tougher job than they used to have."

Gus cleaned all traces of carbon from each of the plugs and then screwed three of them into sockets in the front of a heavy iron case on the work bench.

"Now look through that little glass window and you can see the spark reflected in the mirror at the back of the case," he directed.

Leading into the metal case was a copper pipe on which was mounted a valve and a pressure gauge. Gus attached a wire to one of the plugs, and pressed a button. A steady spark appeared between the points as seen through the window. It was heavy, and quite red in color. Then he turned the valve slightly. As the pressure inside the case went up, the spark faded to a thin, blue-white line, although it held steady without a miss all the way up to a 100-pound pressure.

"That's the way they should act," Gus commented, as he switched the wire to another plug. This, too, passed the test, but the third missed badly at 100 pounds.

"There's a bad one, sure enough," exclaimed Gus. "Did you notice how the spark started to miss as the pressure went up? It's hardly sparking at all at 100 pounds; (Continued on page 121)

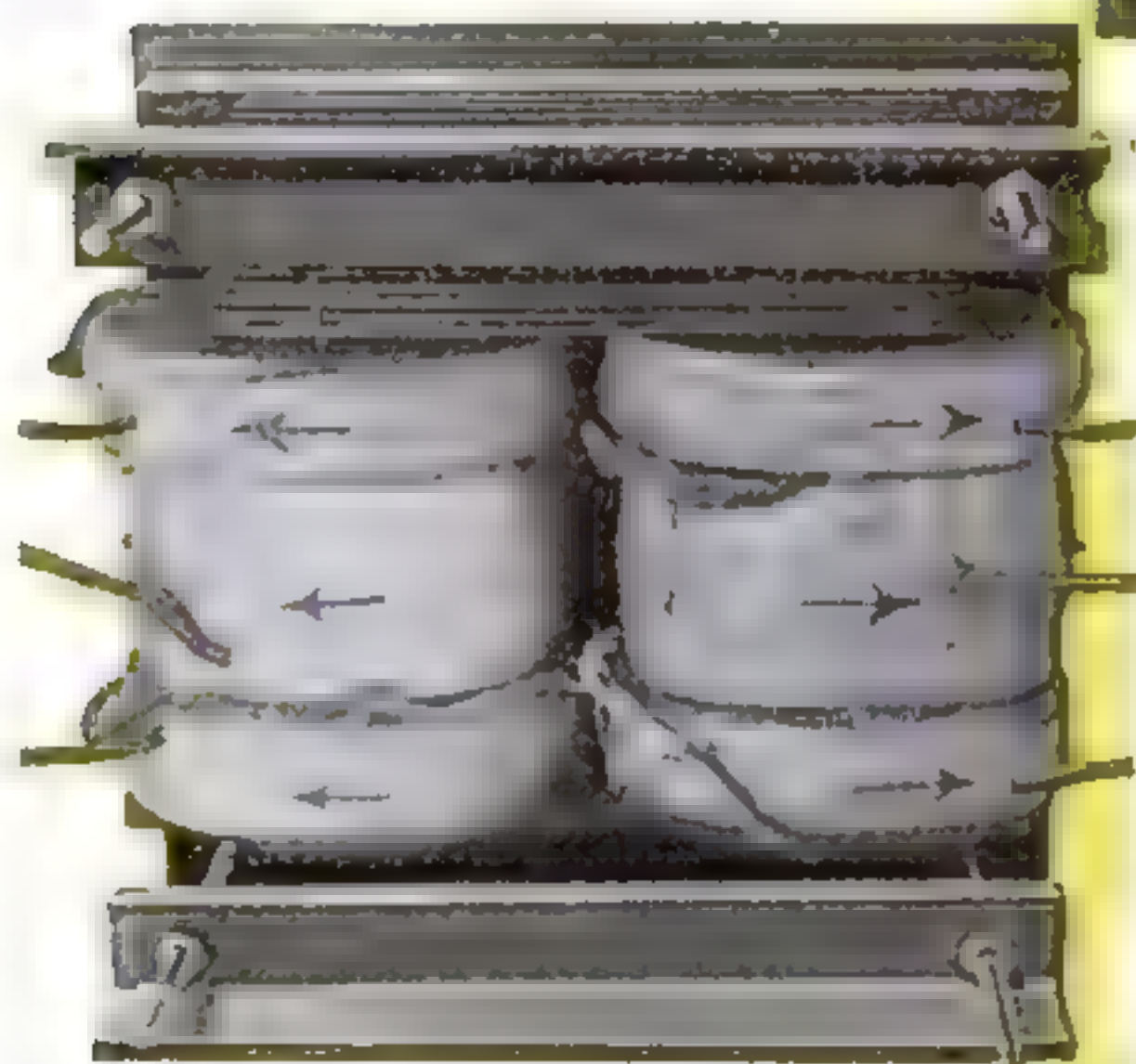
By MARTIN BUNN

EFFICIENT Arc Welder

BUILT FOR
FIFTEEN DOLLARS



Welding with an entirely homemade outfit that can be plugged into any ordinary alternating-current circuit. The mask and rod holder will be described later



The transformer has a normal rating of 2,500 watts

By
KENDALL
FORD

caution of connecting it to the line in a certain way. This is particularly true when the supply-line voltage is 220 volts. The transformer to be described is of the straight transformer type, that is, one having a separate primary and secondary winding, which eliminates any possibility that the operator will receive a shock.

Briefly, the principle of arc welding is based upon the fact that when the electrode is brought into contact with the article to be welded and then drawn a short distance away, the arc formed between the point of contact and the electrode will cause the temperature of the immediate area to rise to about 6,500 degrees F. This tremendous heat causes a pool of molten metal to form, which, when cooled, joins the parts in a firm, sound union.

Two types of electrodes may be used in arc welding, each of which has its own applications. The metal type supplies the metal for the weld, whereas the carbon

type merely forms the arc to which welding rods must be fed.

The transformer to be described has a normal rating of 2,500 watts and an overload rating of approximately 4,000 watts for short periods of time. Approximately 50 lb. of No. 26 gauge transformer iron will be required for the core. This may usually be obtained from the salvage yard of the local power company. If transformer iron is not available, stovepipe iron, available at tin shops, may be substituted. Approximately 45 sq. ft. will be required.

Since the size of the sheets of iron available in either case will not cut up evenly, allowance for waste will have to be added to the amounts mentioned. In case stovepipe iron is used, it is advisable to coat each separate piece with thin shellac and allow it to dry before using.

Cut the iron to the sizes shown in Fig. 1, and provide enough of each size to make two stacks, each 5 in. high when pressed closely together. Divide the longer core pieces, or laminations, into two equal stacks, and form into core sections as shown in Fig. 2. A temporary form may be made by driving nails into a board. The end nails should be the length plus the width of a lamination apart, or 11 in. When half of the longer laminations have been alternately stacked, press them together and wrap the strips of friction tape around the section.

Remove the laminations from the form

HERE is an inexpensive homemade arc welder that can be plugged into any ordinary alternating-current circuit as easily as an electric iron. Its adaptability to a wide range of jobs makes it equally suitable for the home workshop or a commercial repair shop, and it will perform as satisfactorily as commercial welders costing several times as much.

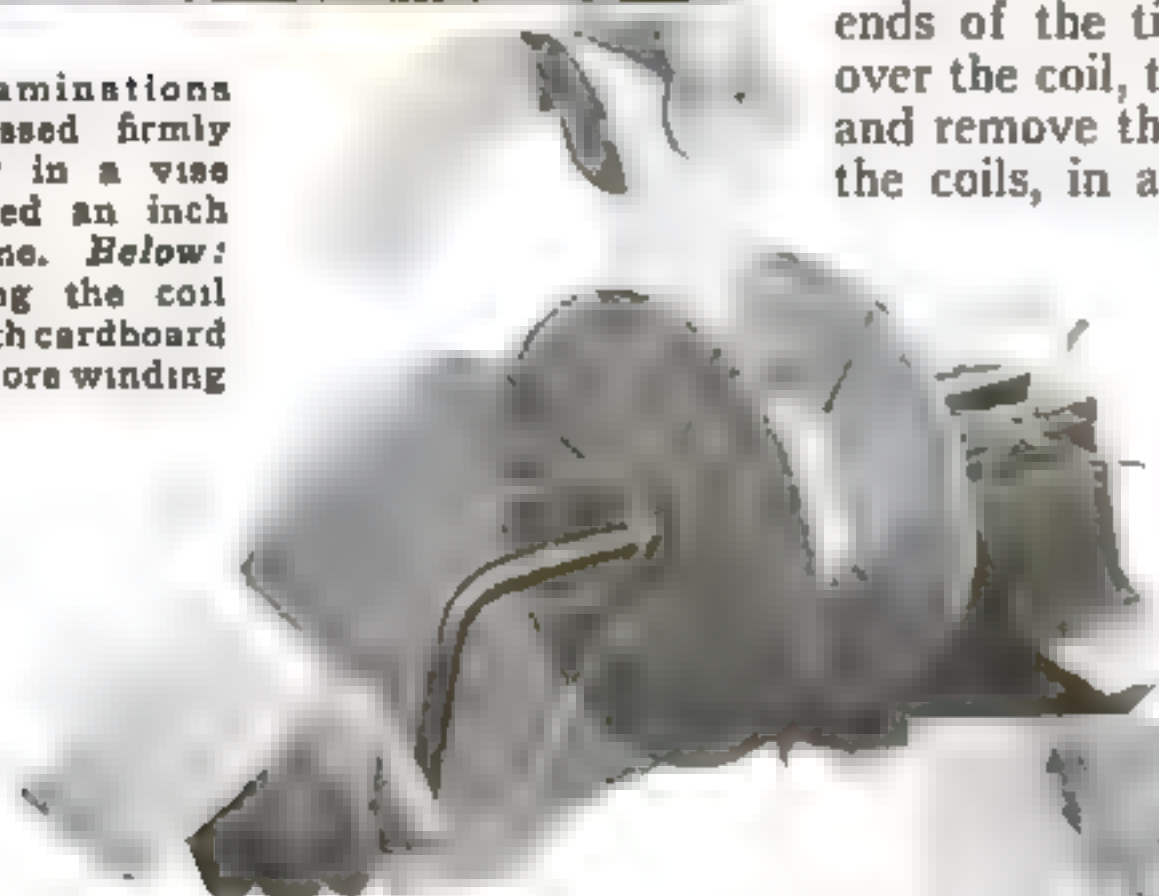
Allowing for variations in the price of the materials in different sections of the country, the cost should not exceed fifteen dollars. If salvaged materials such as bolts, angle iron, and screws are available, making it necessary to purchase only the wire and the transformer laminations, the cost may be reduced about a dollar and a half.

For alternating-current arc welding, either a straight transformer or an autotransformer is used. Although somewhat cheaper to build, the autotransformer may give the operator a disagreeable, if not dangerous, shock unless he takes the pre-

In this age of steel, welding takes its place with gluing as one of the most common and universally useful operations. If you work with metal, you should have welding facilities. It doesn't matter whether you merely do occasional repair jobs or wish to build something as elaborate as the all-welded trailer described last month (P.S.M., May '37, p. 86). Fortunately, you can make most of the equipment you need, and Mr. Ford will tell you just how to do it in a series of articles, of which this is the first.



Core laminations are pressed firmly together in a vise and taped an inch at a time. Below: Wrapping the coil form with cardboard strip before winding



carefully and place them in a vise with about 1 in. of the solid portion of the section extending beyond the jaws of the vise. Tape the solid portion of the core by moving the whole section outward from the vise about 1 in. at a time. Take the taped section from the vise and wrap it with an additional layer of friction tape. Repeat the operations with the remaining long laminations, and coat each section with shellac. Before the shellac dries, cover the taped portion of each section with a layer of regular insulating cloth or tape.

The windings consist of two primary coils and four secondary coils, all wound with No. 10 D.C.C. (double cotton-covered) wire, of which approximately 36 lb. will be required. It will be noted in Fig. 4 that each group of windings is connected in parallel, which permits using wire of a size that can be easily wound and makes possible a more efficient arrangement of the coils on the core. If single coils were used, the primary winding would have to be No. 7, and the secondary No. 4, both of which would be extremely difficult to wind. With the primary divided into two sections, the transformer may be used either on 110 volts or 220 volts simply by changing a connection at the terminal strip.

A winding form for winding the primary and secondary coils is shown in Fig. 3. Since the primary coils are just twice as wide as the secondary coils, the wood center of the winding form is in two sections so that one of them may be used when winding the secondary coils.

Place a piece of small size wire or strong string in each slot in the center of the winding form to serve as bindings for the completed winding. Wrap the center section of the form with several layers of thin cardboard and insert about 10 in. of the No. 10 wire through the hole provided in the side of the winding form to serve as a coil lead. Place a short piece of pipe

in a vise, insert the shaft of the winding form into the pipe, and proceed with the winding of the coil.

The turns should be placed on evenly with enough strain to make the wire follow the square outline of the winding form. If the winding is put on loosely, it will tend to assume a circular shape and take up more space than it should. The coils may be wound either to the right or to the left, but in either case they should all be wound in the same direction. Two coils of 210 turns each will be required for the primary, and four coils of 140 turns each for the secondary windings.

As each winding is completed, bring the ends of the tie wires or strings together over the coil, take the winding form apart, and remove the coil from the form. Tape the coils, in and out through the center, with cotton or linen tape. Leave the cardboard in the center of the coil in place, but remove the tie wires as the taping proceeds around the coil.

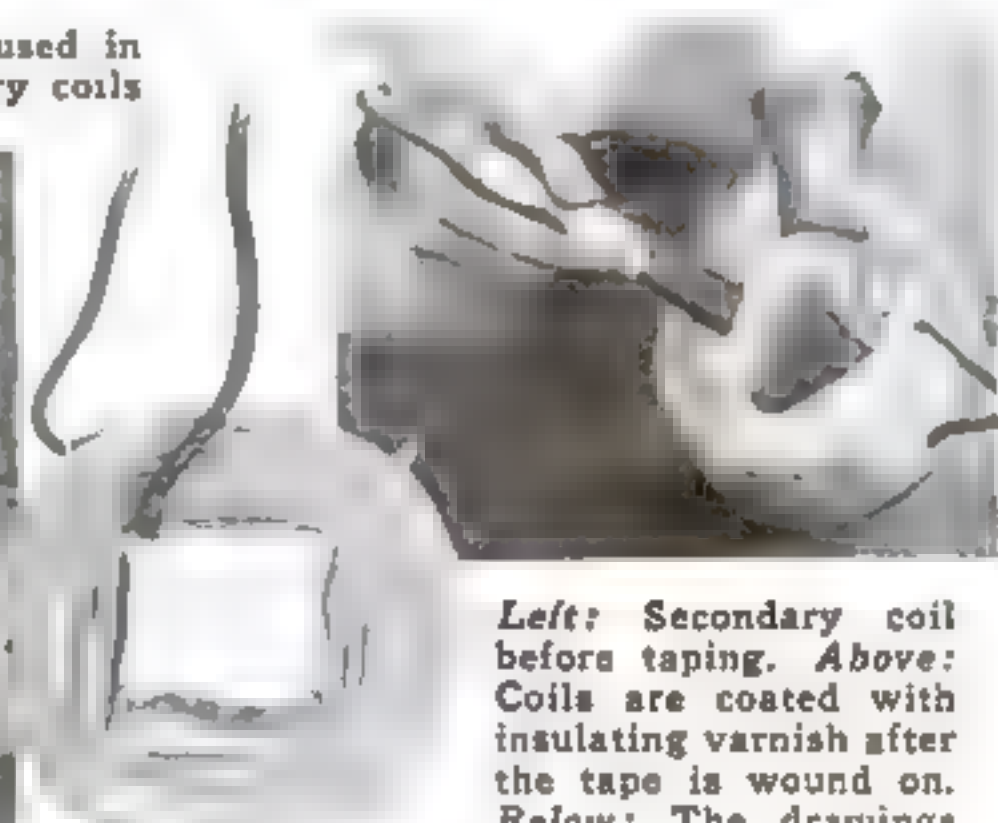
Since the insulation on the ends of the coils is apt to become frayed during the assembling of the transformer, it is advisable to place short pieces of cotton sleeving, such as armature winders use, over the leads of each coil. Give each taped coil a coating of insulating varnish or shellac, and allow it to dry.

Set the completed core sections on end and insert one half of the total number of short core laminations in such a way as to join the two sections together. These laminations are placed alternately, similar to the longer ones, as indicated in Fig. 2.

The coils are placed as shown in Fig. 5 so that those on one leg of the core will have their windings running in an opposite direction to those on the other leg of the core. It is advisable to mark the coils with an arrow to indicate the direction of the end lead of each to facilitate connecting the coils to their terminal strips. When the coils are in position, the remaining core laminations may be placed between the core sections.

(TO BE CONTINUED)

How the winding form is used in preparing one of the primary coils



Left: Secondary coil before taping. Above: Coils are coated with insulating varnish after the tape is wound on. Below: The drawings

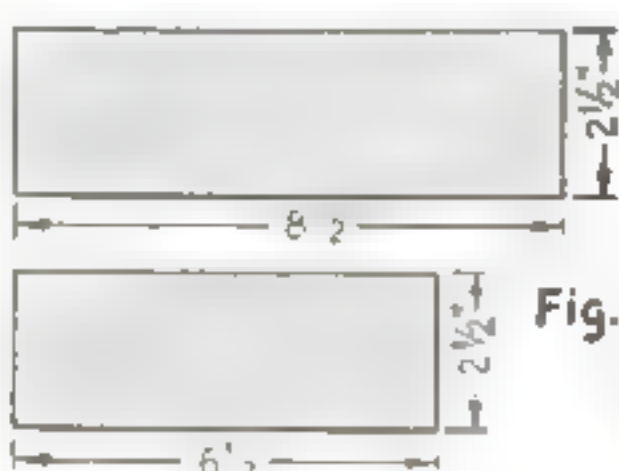


Fig. 1

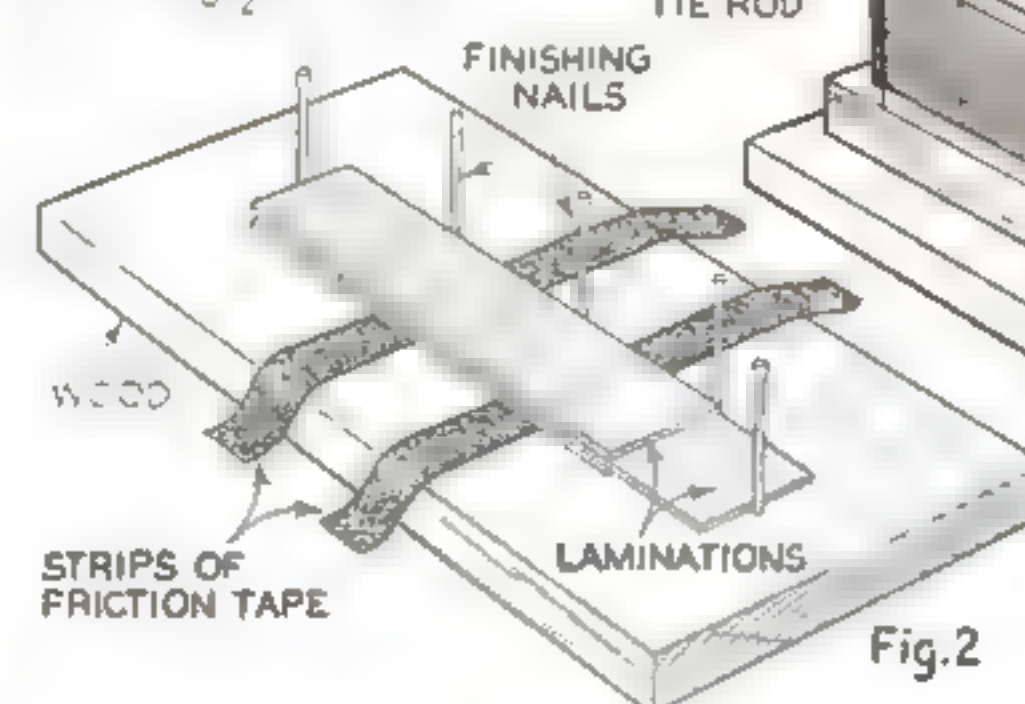


Fig. 2

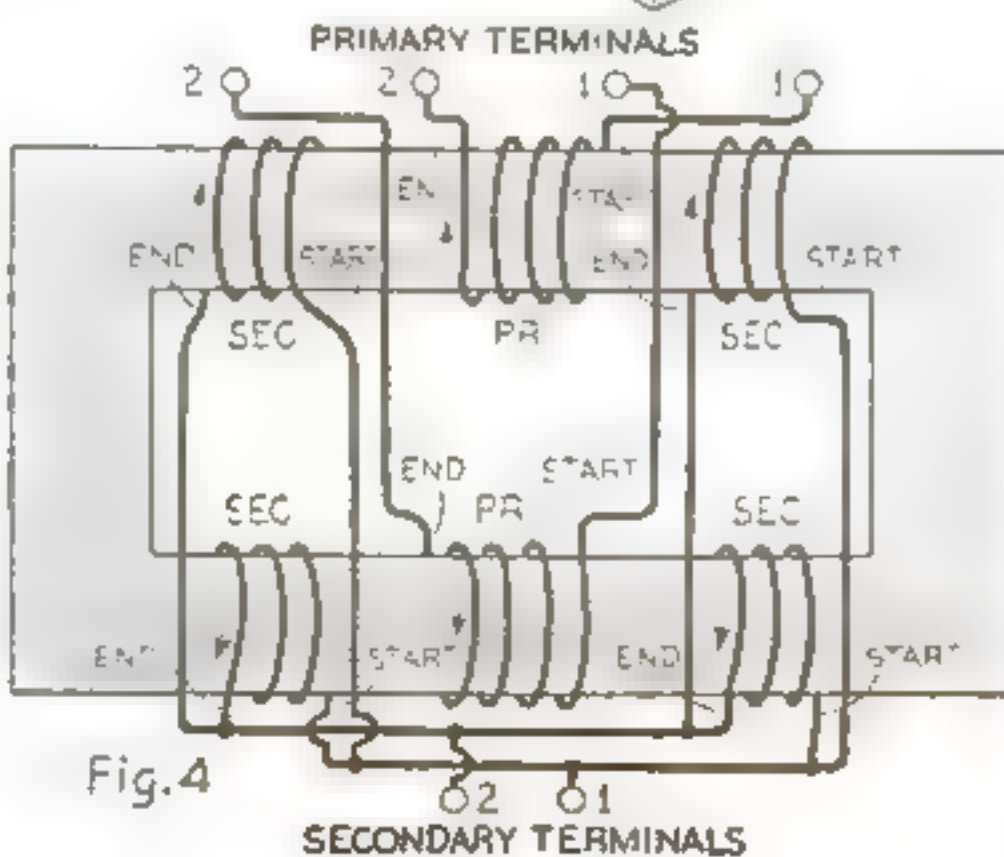


Fig. 4

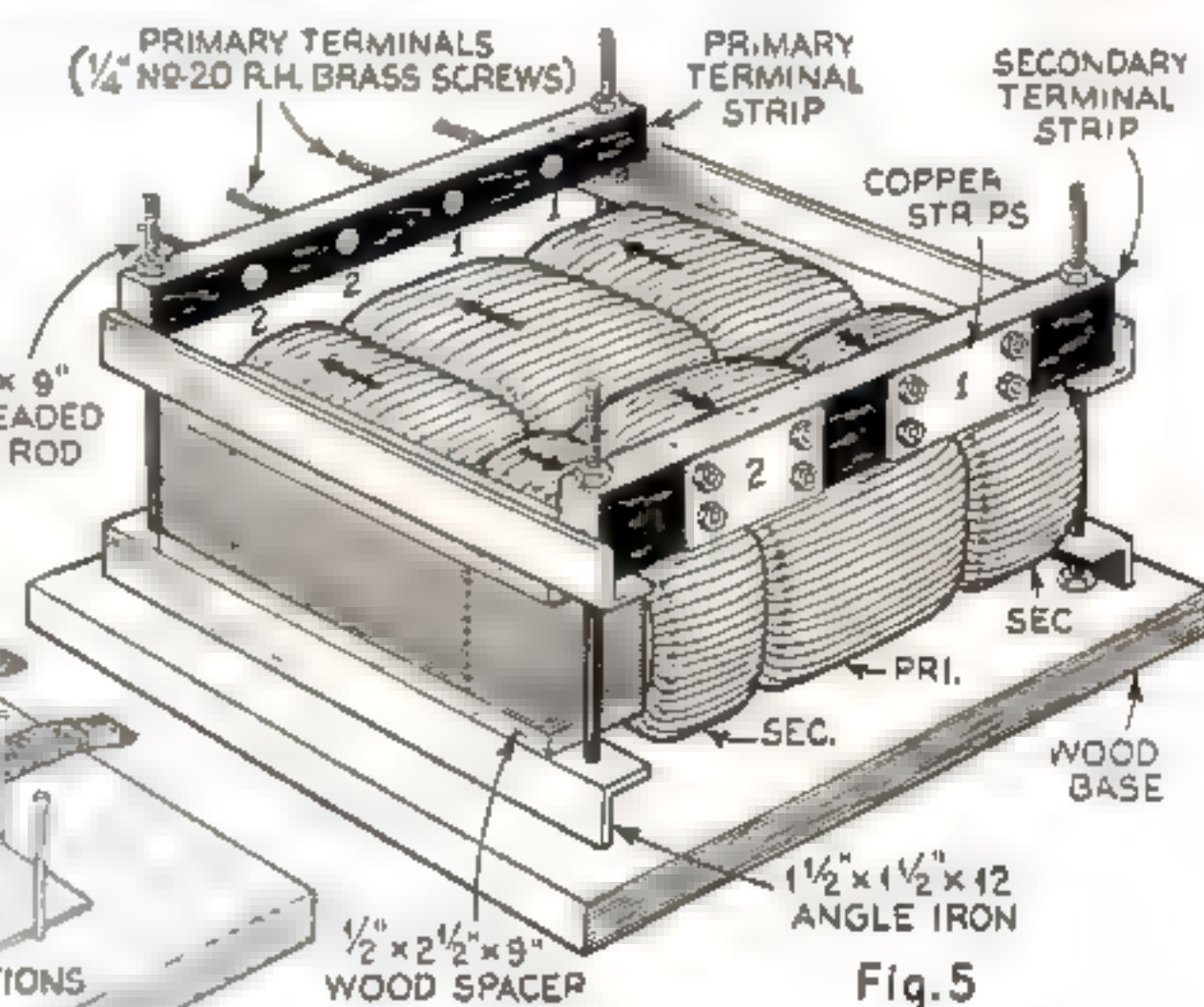


Fig. 5

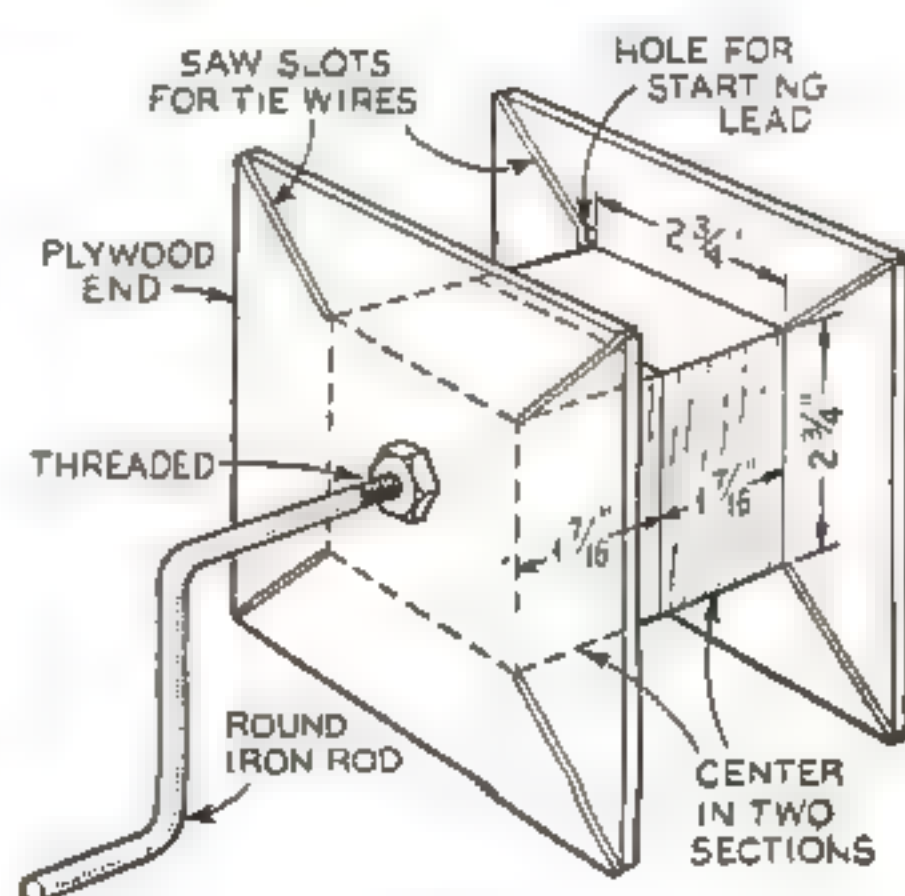
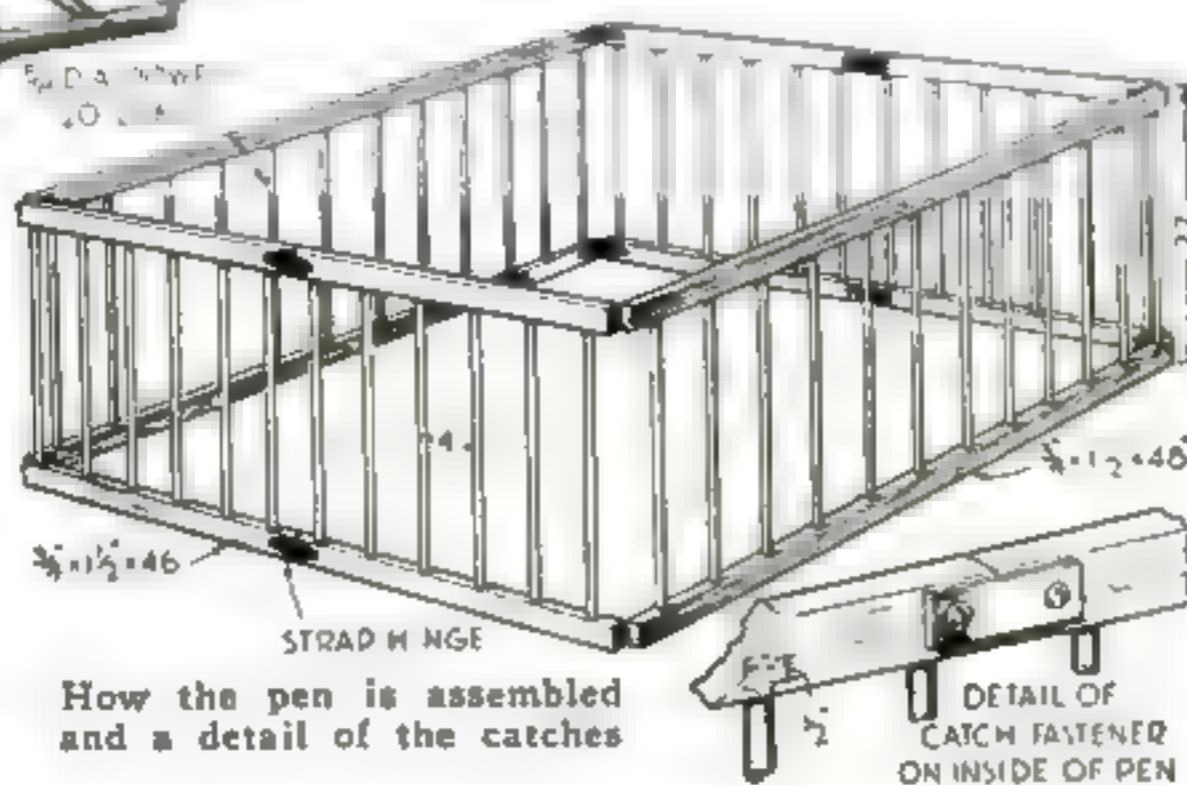


Fig. 3

BABY'S PLAY PEN FOLDS INTO A DRYING RACK



The pen is sturdily built for use indoors or out. It also acts as a rack for drying the baby's clothes when set up as shown at left.



How the pen is assembled and a detail of the catches

BECAUSE of its unusual hinged construction, the play pen illustrated can be quickly converted into a rack for drying the baby's clothes, and it folds flat when not in use.

The materials: 4 pc. wood $\frac{3}{4}$ by $1\frac{1}{2}$ by 48 in.; 4 pc. $\frac{3}{4}$ by $1\frac{1}{2}$ by 46 in.; and 48 dowels $\frac{5}{8}$ in. in diameter and 20 in. long. Hardware: 8 strap hinges for corners; 4 strap hinges for the center of the shorter sides; 4 pc. strap steel 3 by 1 by $\frac{1}{16}$ in. for making fasteners as shown.

After you have assembled the four sides, fasten them together with strap hinges at the corners, top and bottom. Place hinges on the outside of the top and bottom rails opposite the center lines of the shorter sides. Attach the fasteners to the inside of

the rails opposite the hinges, then saw the rails in two at the hinges.

The pen may be left unpainted, or if this is not desired, a good grade of lacquer is the safest finish, as the baby, while teething, is likely to chew off paint or enamel in places.

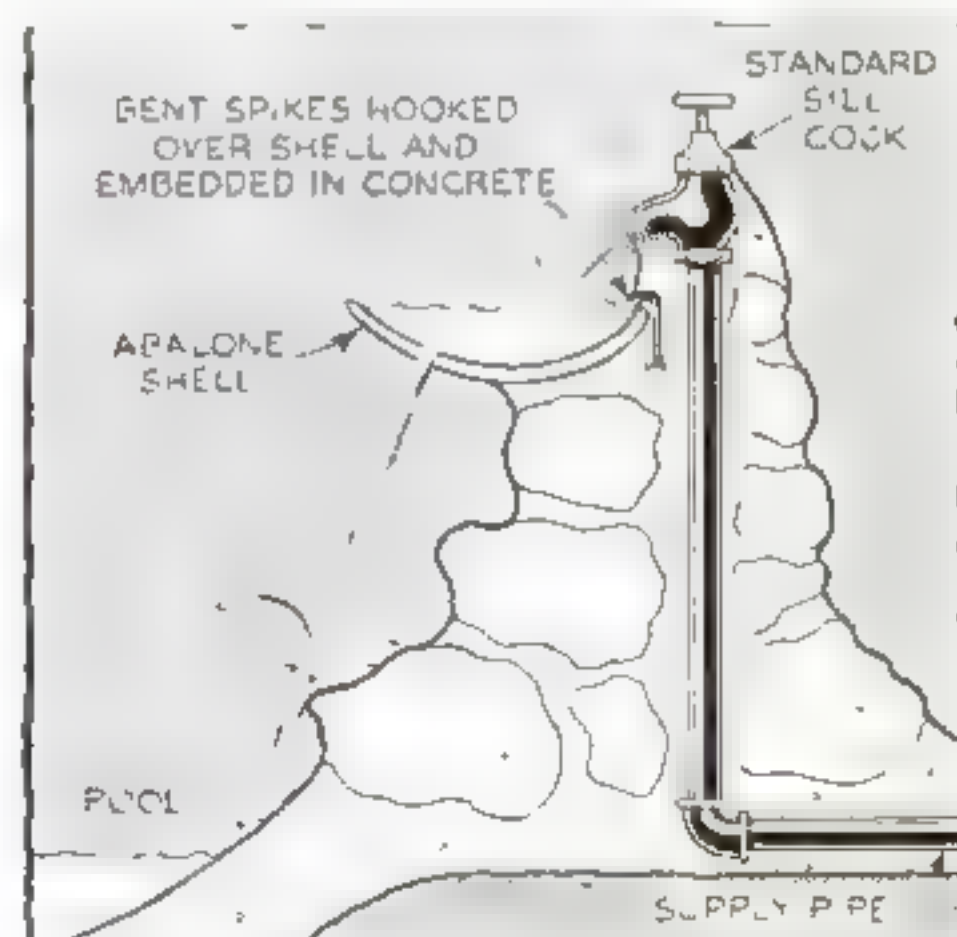
When used as a drying rack, it is unusually efficient if placed over a hot air register.—JOHN H. MOTE.



PERFORATED SHELL USED AS FOUNTAIN BASIN

LARGE abalone shells with their ring of small holes near the edge make attractive basins for garden fountains. They can be obtained at many curio stores. Select a large one and set in concrete on a rock pedestal, as in the drawing. Bent spikes serve as reinforcement and hold the shell securely. For the concrete, use clean, dry sand and Portland cement in the ratio of five to one, mixed dry; then add water.

The fountain shown above was built by Harold Hahn, of Pasadena, Calif.



Shell and pipe are embedded in the rockwork

CLAMP AIDS WHEN DRILLING IN LATHE

ACCURATE drilling in the lathe is easier if the drill vise is held centrally on the drill pad with a simple little clamp made as shown. The clamp is sawed from a piece of $\frac{1}{2}$ -in. cold-rolled steel. One end is drilled, tapped, and fitted with a thumb-screw; and two pins or lugs of steel or brass are set in the underside to fit over the back of the drill pad and prevent the vise from falling once it has been properly placed to center the work.—W.W.



Made as shown at left, the clamp holds the drill vise centrally on the drill pad. The two lugs are tapered to suit the taper of the back of the drill pad and make it impossible for the work to slip.



ALUMINUM PLANT LABELS

DURABLE plant markers may be made by cutting strips of thin aluminum into miniature pennants about $1\frac{1}{4}$ in. wide and $3\frac{3}{4}$ in. long. These are fastened with two rivets each to tiny flagpoles of copper, brass, or galvanized-iron, $\frac{1}{4}$ in. wide and 12 in. long, pointed at the lower end so they can be thrust into the earth. Rub the aluminum to a satin finish with fine steel wool, and write the names on with waterproof ink or pencil.—H. R. WALLIN.



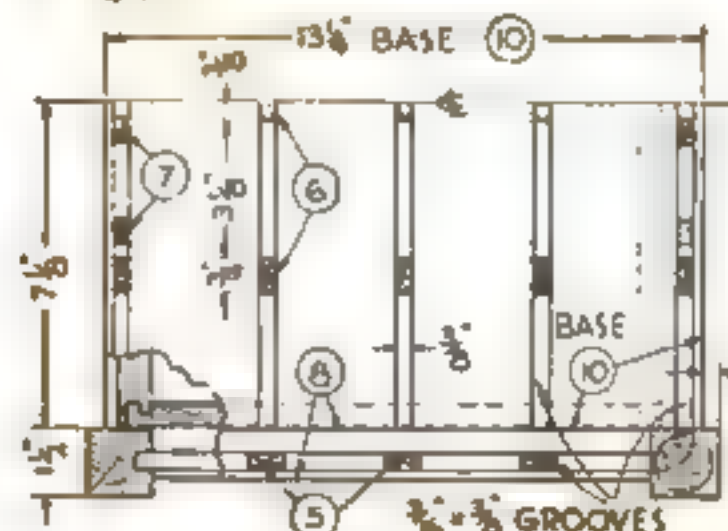
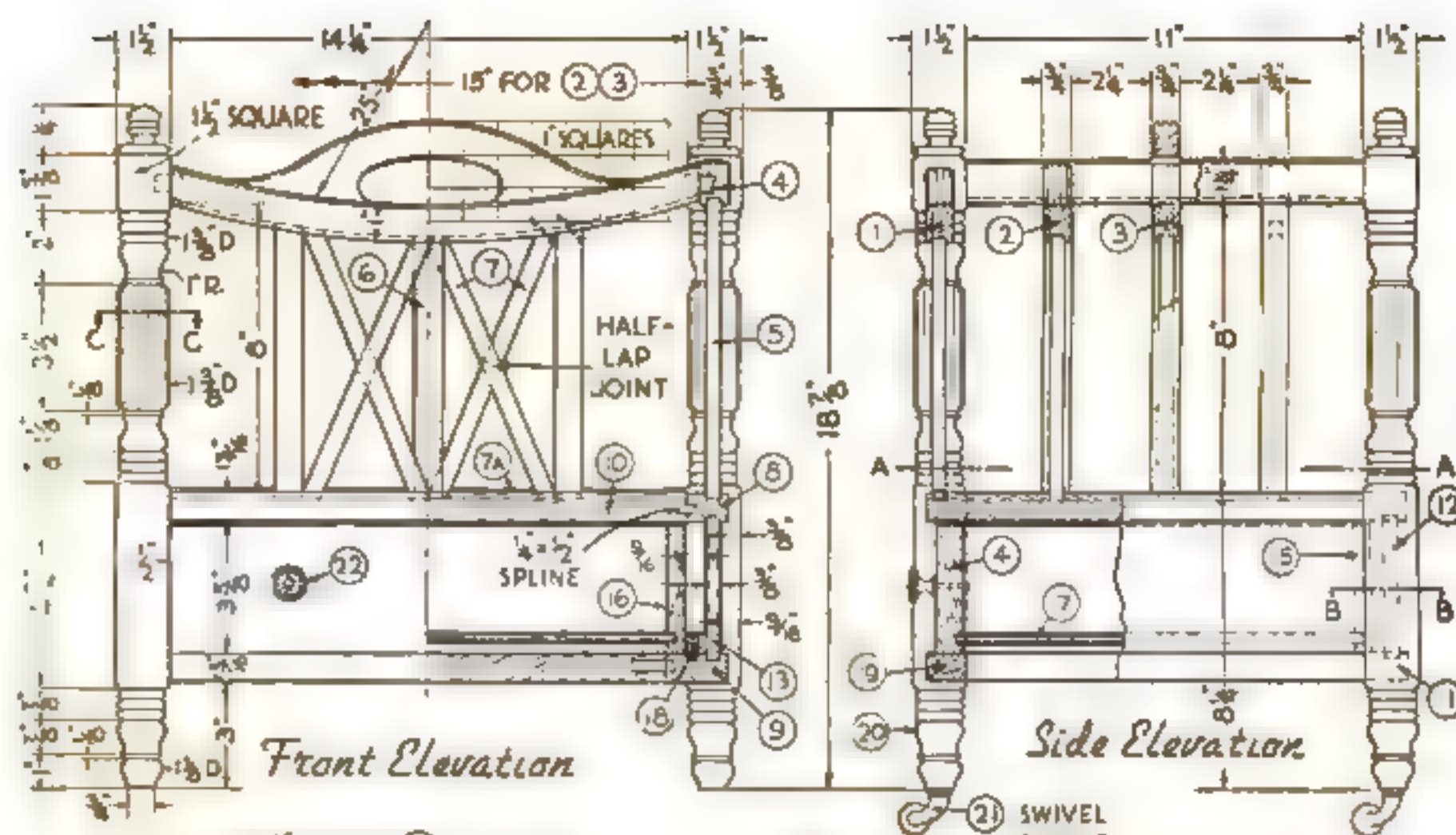
A black and white photograph of a woman sitting on a wooden crate. She is wearing a dark, patterned dress and is holding a book or document in her lap. The background is a plain, light-colored wall.

DESIGNED in the graceful style of an eighteenth century Canterbury, this small piece of furniture is worthy of the best efforts of any craftsman. Either walnut or mahogany, the favorite cabinet woods of that period, should be used.

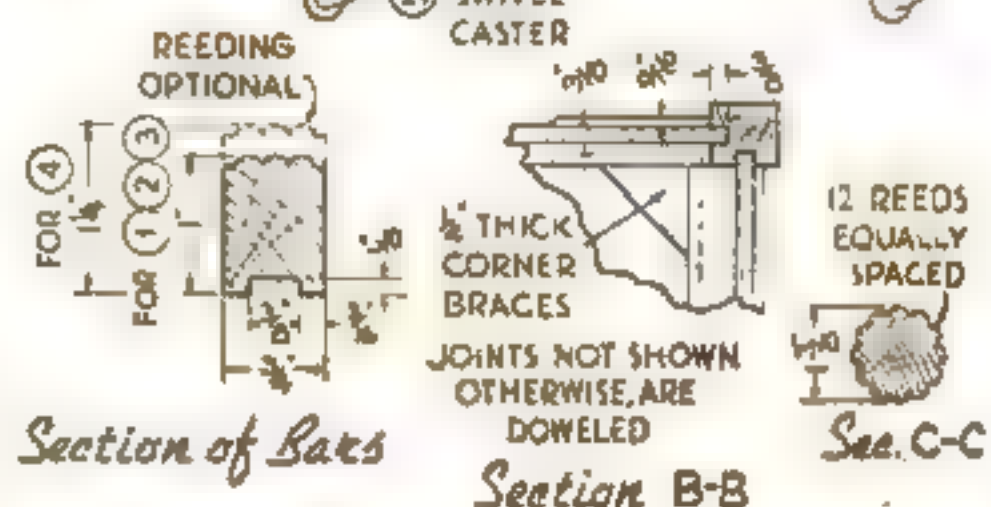
It is advisable to make a full-size layout of at least half the front elevation, showing the curved bars, latticework, and corner post. Dimensions not shown on the drawing may be found in the list of materials on page 102.

After the corner posts have been turned, a cradle should be made to hold them while the reeding is done on the lathe, drill press, or shaper. The cradle illustrated was designed for use with work of varying lengths; it may, of course, be greatly simplified, if made for this one job only, by eliminating the sliding tailblock and setting the dead center directly in the rear end crosspiece. The disk for this job is graduated in twelve equal divisions, one for each cut. When used on the drill press and shaper, the cradle is guided by strips or blocks clamped to the table.

The top edge of the cross and side bars and handle may also be reeded, which will enhance the appearance of the finished piece. This work may be done against a collar in the shaper or drill press, or better yet, against



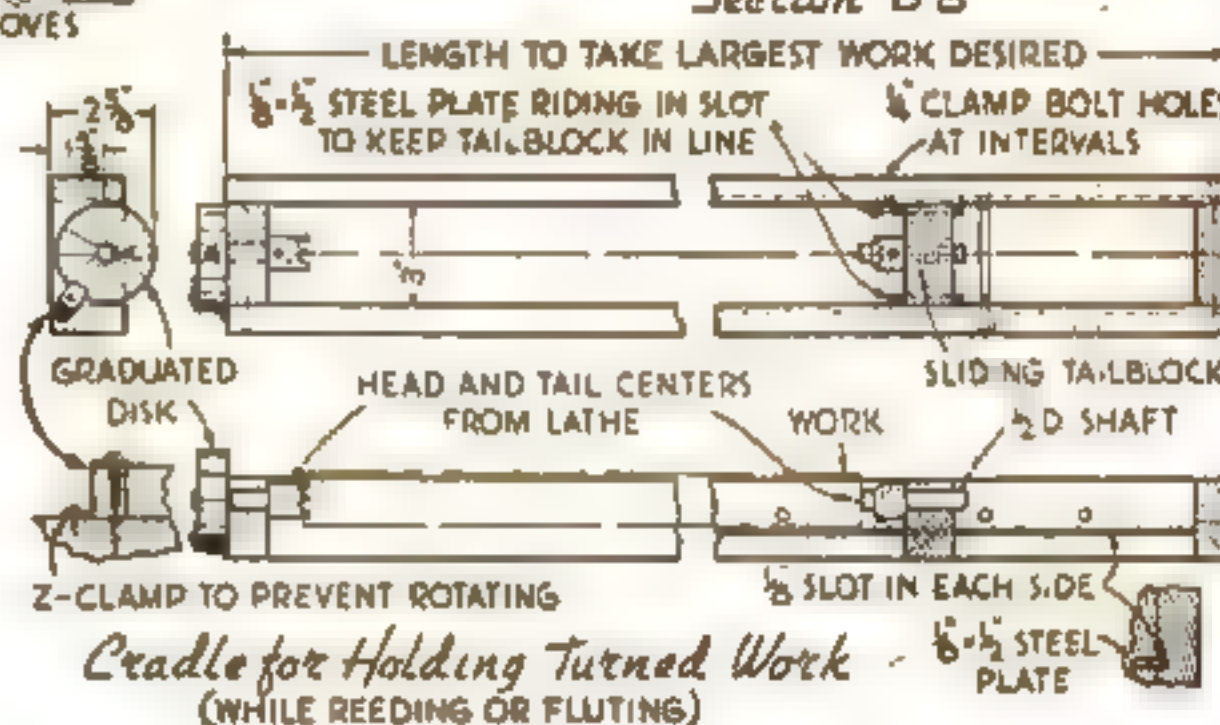
Section A-A



Section of Bats

Section B-B

Here are the complete drawings, as well as plans for a reeding or fluting cradle. The photographs below show how reeding is done on the shaper, lathe, and drill press; also how the trial assembly is made to test the joints.



Cradle for Holding Turned Work (WHILE REEDING OR FLUTING)



a convex guide cut to the same radius as the work.

Each side should be first assembled as a unit. In order not to confuse the drawings by including too much detail, not all of the dowel joints have been indicated. They are used, however, at the ends of all the bars and stretchers where needed. The slats and latticework may all be inserted after the rest of the assembling is completed. They are bradded at the upper end and locked in the grooves at the lower end by spacers glued in place.

The drawer is made up to fit the opening in the frame after it has been glued up. The guides marked 18 are put in place last. The knobs on the drawer should be of simple design. Rubber-wheeled, ball-bearing casters should be used on the feet.—D. A. PRICE.

(The list of materials appears
on page 102)

Cost Little for Materials

Butler's Table Built in Simplest Way

OCCASIONALLY an extremely simple piece of furniture wins favor over much more elaborate designs. Such is the case with this attractive butler's table.

It may be made in two styles, both suitable to modern furniture arrangements. If built as shown with a removable tray, it may be tucked in a corner, out of the way, when not in use. If, on the other hand, the top is permanently attached, it may be used as an occasional table or as a convenient magazine bench.

Although hardwood is preferable, almost any material at hand may be used. The bottom of the tray should be of $\frac{1}{4}$ -in. plywood as it is usually subjected to considerable abuse. If a permanent top is desired on the table, it, too, may be of plywood.

Construct the table first with simple butt joints. Divergent saw-edge corrugated box fasteners, $\frac{1}{2}$ -in. No. 5, may be used instead of glue for assembling the individual pieces. The fasteners should, of course, be driven into the inside surfaces. Although not intended for use in making furniture, they provide a quick method of obtaining a strong joint.

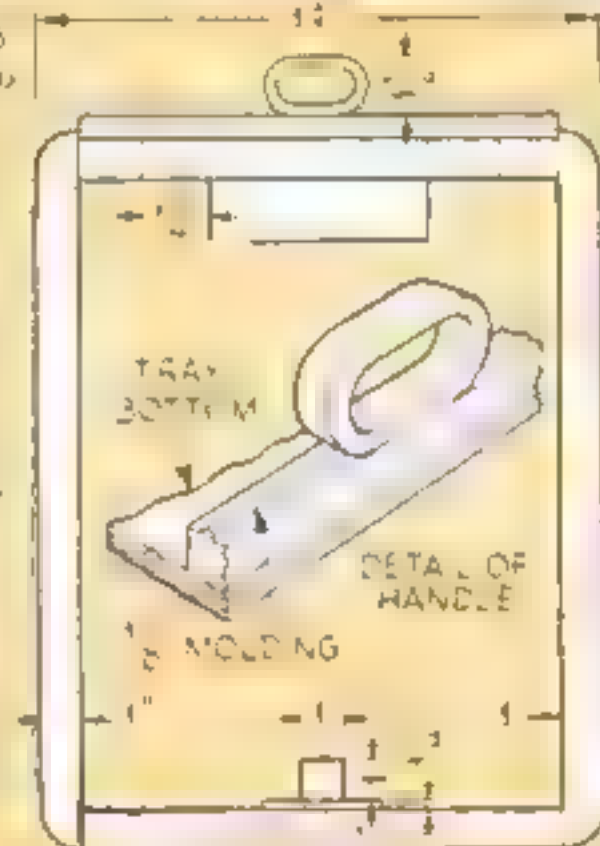
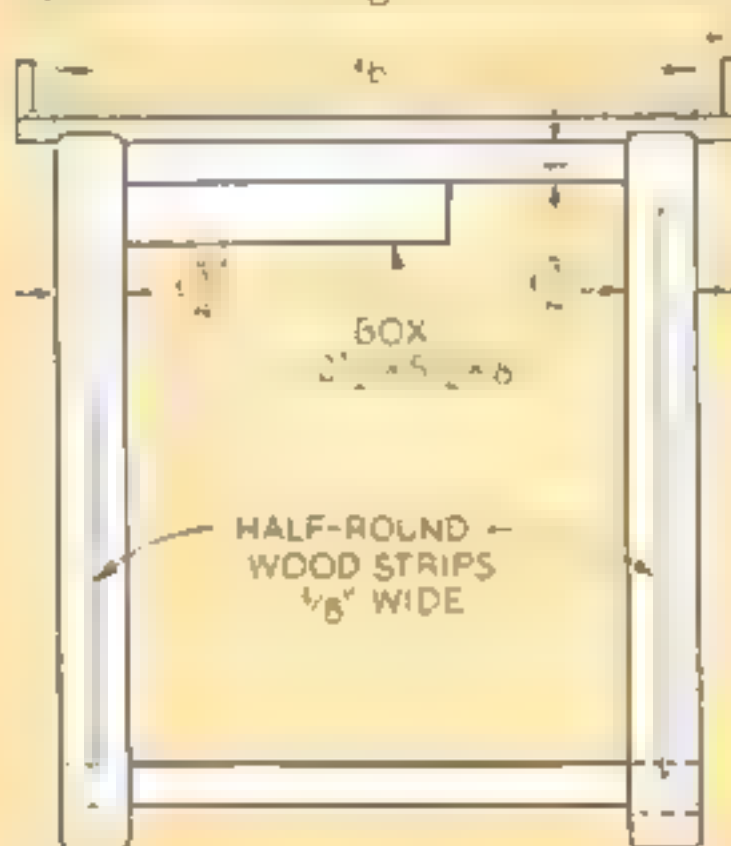
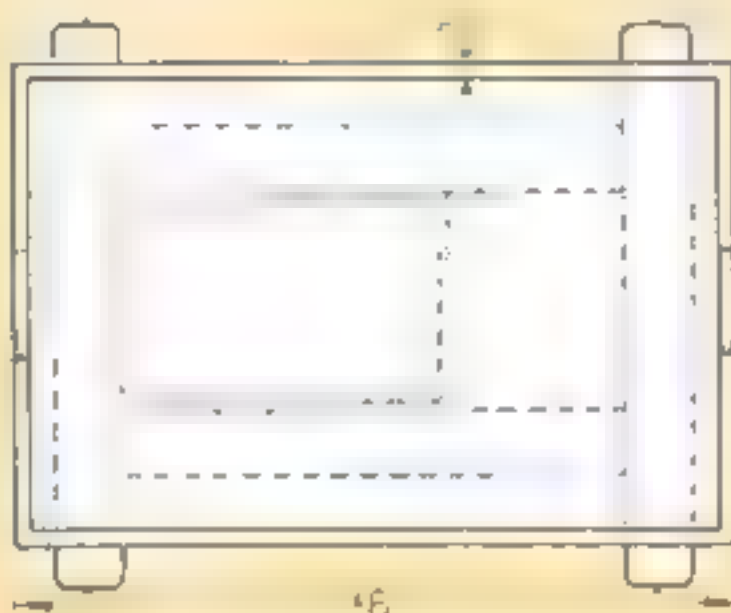
A box for silverware is attached to the two cross members. A cigar box may be used if the wrappings are removed and the inside is smoothly sandpapered. If a permanent top is fastened to the table, the cigar box may be converted into a drawer by providing two small rails.

Enamel the table black, and while it is drying, construct the coffee tray. The sides are $\frac{3}{8}$ -in. square, and the two handles are made as shown and screwed to the bottom. The plywood bottom and the handles may be stained any shade desired or painted a contrasting color. The sides should be enameled black. Two jar rubbers are fastened to the underside.

Small half-round strips of wood ($\frac{1}{8}$ in. wide) are finished in a light color and fastened with brads to the sides of the tray, to the legs, and to the cross brace of the table.—GEORGE B. HARRAN.

PLAIN BUTT JOINTS ARE USED

The piece is made as shown in the drawings below, with plain butt joints. Corrugated fasteners, driven from the inside where they are inconspicuous, hold the individual pieces together. A cigar box serves for the silverware container and is reached by lifting up the tray. Narrow moldings are applied after the enamel is dry as indicated at right below.



Attractive Paneled Wastebasket Made of White Pine



Two of the four raised panels are of knotty pine. Right: Jig to aid in cutting mortises



WHITE pine is used for this distinctive paneled wastebasket. The four frames are mortised and tenoned together, and have grooves cut on their inside edges to hold the panels. The joints are pinned with hardwood pegs after being glued. The upper rails of the frames are $1\frac{1}{4}$ in. wide, the lower rails 2 in. wide, the stiles in two of the frames $1\frac{1}{4}$ in. wide, and in the other two frames, only $1\frac{1}{8}$ in. wide. A simple jig may be made as shown to

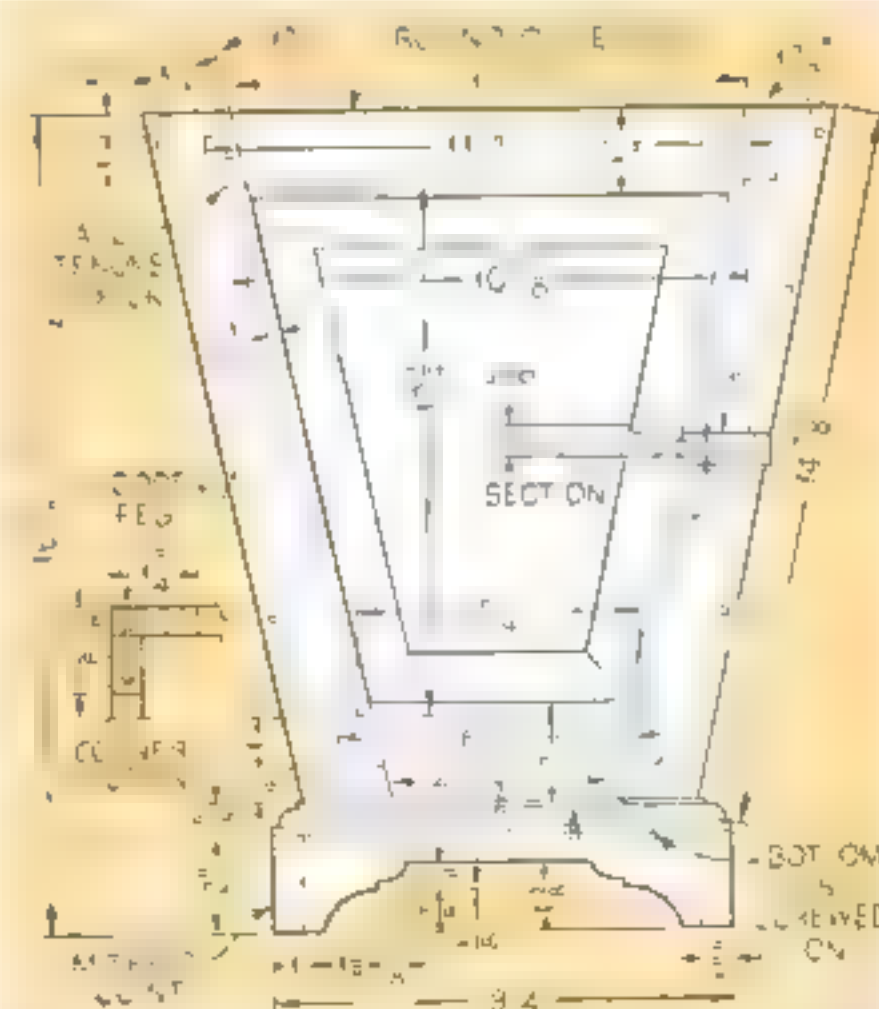
cut the mortises at the proper angle. The bevels on the panels must be cut with chisels by hand.

The lower edges of the frames may be cut to the proper angle by tilting the table or the arbor of the circular saw. Glue the frames to each other and peg them. Dress the joints, then make the floor and screw it to the bottom edges of the frames. The edges of the floor are molded on a shaper, if available. Make the feet, mitering the ends before the brackets are cut. Screw

the feet to the floor, glue the mitered joints, and drive a small brad into each one.—FRANKLIN H. GOTTSHALL.

When the frames have been properly fitted, cut out the $\frac{5}{8}$ -in. thick panels. Set the circular saw to cut $\frac{1}{8}$ in. deep and cut grooves $1\frac{1}{4}$ in. from each edge to form the flat surface of the panel. Next, adjust the saw to cut the $\frac{1}{4}$ -in. tongues along each edge of the

the feet to the floor, glue the mitered joints, and drive a small brad into each one.—FRANKLIN H. GOTTSHALL.



The sides are alike except that the stiles on two are $\frac{5}{8}$ in. narrower than on the others.



Honey Extractor BUILT AT LOW COST

THE five-frame, hand-driven honey extractor illustrated above was made almost entirely from salvaged material. It runs so easily and is so efficient that a child can operate it, and the capacity is large enough for a small apiary.

For the container, a 50-gal. steel oil drum was used, the top being cut off. The cage or reel for holding the frames was made from four standard queen excluders, 16½ by 20 in., with which all apiarists are familiar. These were bent into a circular shape, then wired together. With 8 in. off for overlapping, these give a reel 58 in. in circumference.

A galvanized wire dish drain was wired securely to the bottom of the reel. The comb pockets were made of wire, hinged at the top and bottom of one side, enabling a quick reverse. A steel band 1 in. wide and ¼ in. thick, taken from an old wagon, was run entirely around the reel at top and bottom to brace it. Another strip of the steel band was run from the top of one side, then under the bottom of the reel and up to the top of the opposite side, extending 3 in. above the reel, where it was finally bent across the top, to make the cross arm. Bolts were used to hold the bands of steel in place.

The gears were taken from a discarded ice-cream freezer of 3-gal. capacity. They were fastened with screws to a 2 by 3-in. wooden bar, which extends across the top of the can. The "two by three" clamps to a 2-in. wide steel band that circles the top of the can, and can easily be removed whenever necessary.

A 10-in. bolt, extending from the center of the gears and fastened to the cross arm, permits the reel to spin almost without effort. The crank was salvaged from a worn-out clothes wringer. Any similar type will do.

All the mechanism of the extractor is above the reel and out of the honey, which is drained through a faucet at the bottom of the can. It is a simple yet sturdy machine, and removes the honey from the frames without any injury to the combs. Considerable time and money are saved by its use.—MARJORIE COOK.

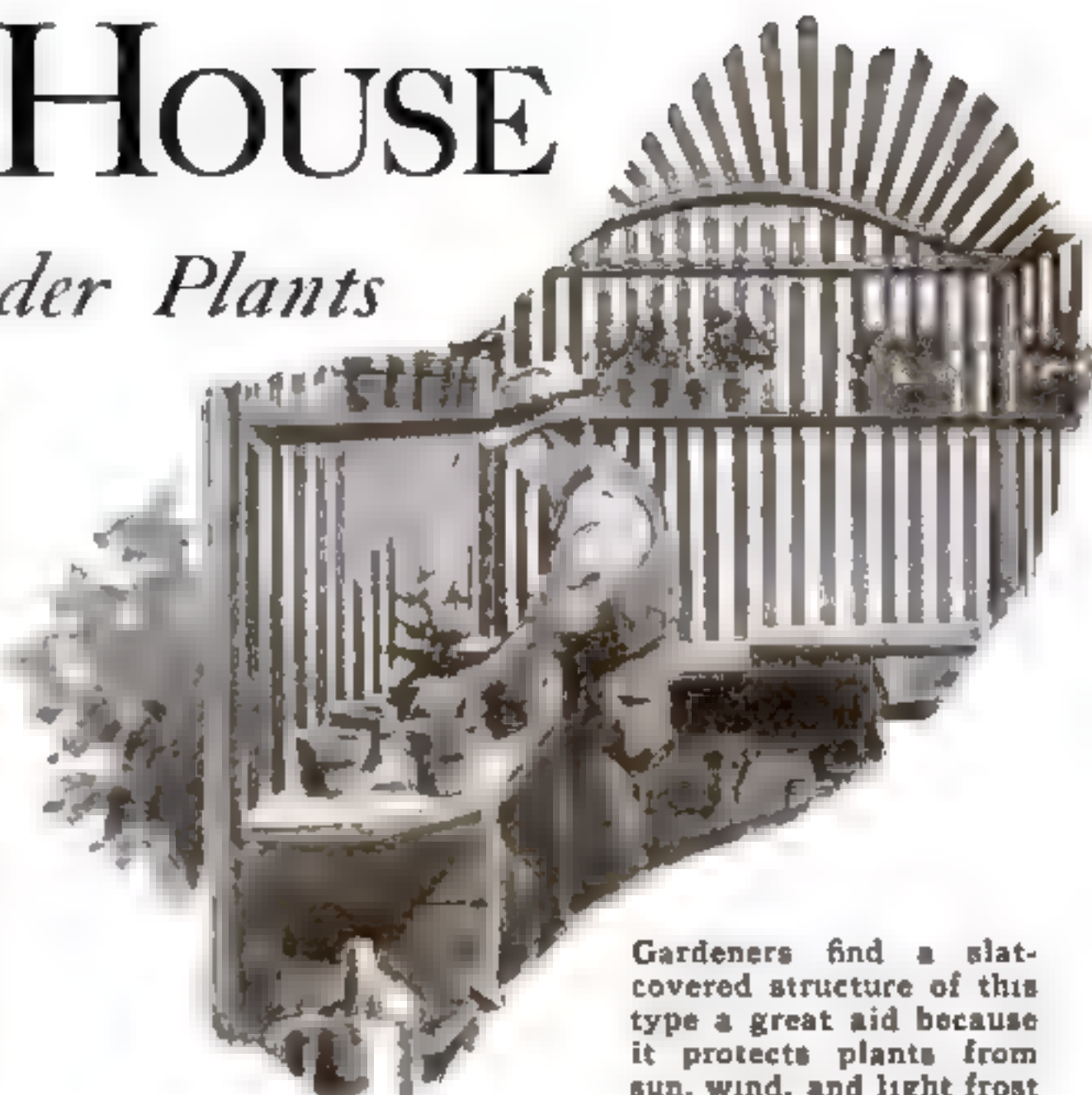
LATH HOUSE

Saves Tender Plants

AMATEUR gardeners find a lath house helpful in raising seedlings and tender plants that are not yet sturdy enough to resist continuous sunlight.

There is no trick in building a lath house; in fact, an efficient one may consist simply of a rectangular frame with slats over it. With very little extra effort, a more sightly structure can be erected. It may be stained for a weathered effect, with perhaps a bit of bright color on door and panel. The long dimension of the house should run from east to west, the side slats be placed vertically, and the roof slats laid north to south, so the sunlight and shade will alternate regularly.

Rough lumber can be used for the framing. Set the sills on concrete blocks or flat stones. The gracefully curved roof line is obtained with band-sawed rafters of 1-in. material, made in pairs and joined in the middle as shown. Battens of pine or, if available, redwood are nailed over

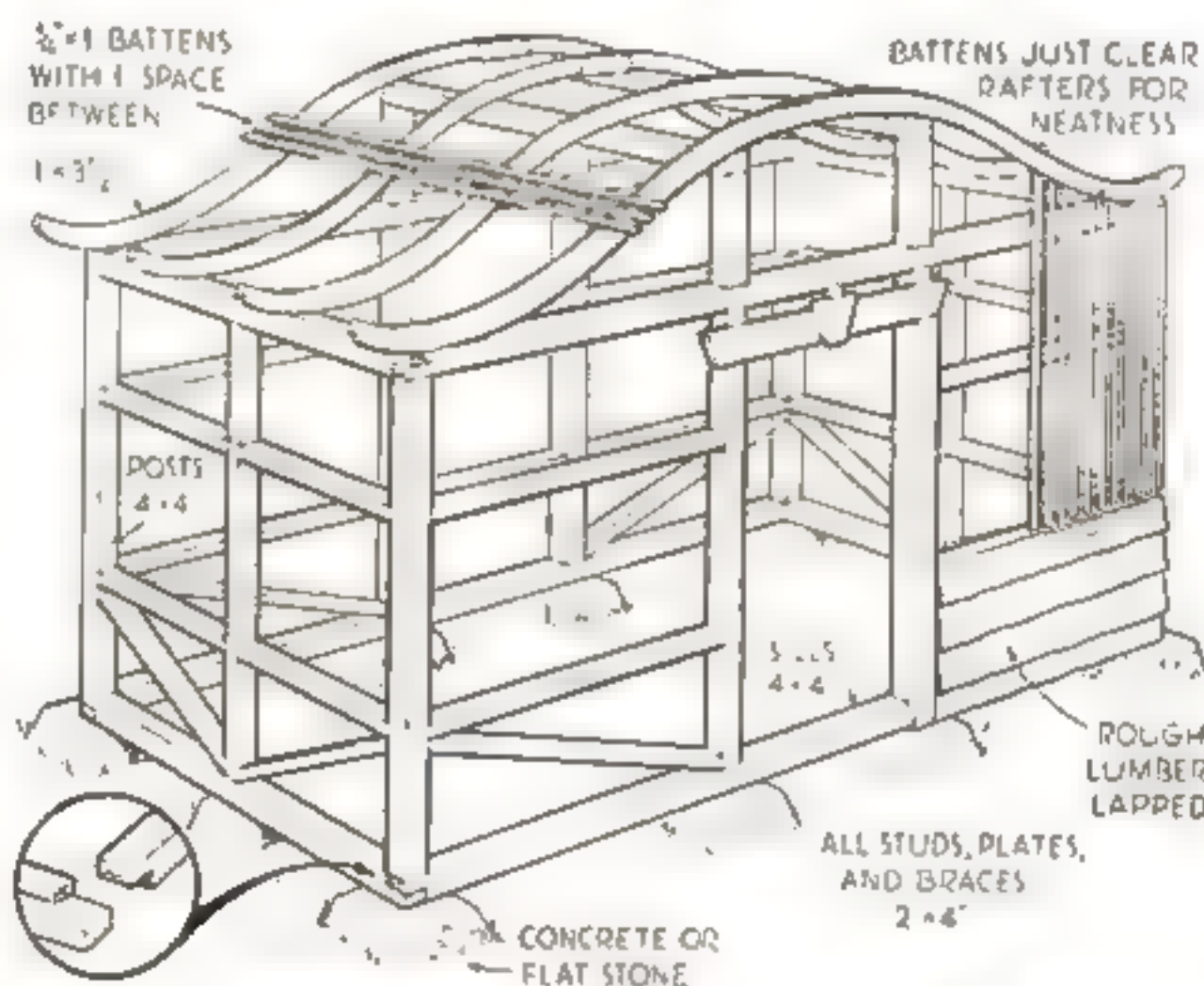


Gardeners find a slat-covered structure of this type a great aid because it protects plants from sun, wind, and light frost

these, spaced their own width apart. Battens are also nailed vertically on the sides. On all four sides is a "skirt" of rough lumber, lapped as illustrated. Benches can be arranged inside as desired. In this case they are arranged along the walls, though some gardeners prefer to have a single large table in the middle.

An added convenience is a water-tight wooden tray made of matched or calked lumber. In this potted seedlings are placed in about an inch of water so that the moisture seeps up from the bottom. As soon as the top soil in the pot appears moist, the water in the tray is drained off. As there will be a good deal of excess water on the floor, it should be filled with 5 or 6 in. of cinders or gravel.

Various simple designs for your lath house can be easily worked out so that the structure will have the general charming outline of the old-fashioned type of formal summer house often seen in well-kept gardens.—H. SIBLEY.



With its graceful roof line, this slat house is attractive as well as inexpensive and practical

Recording Barometer

MADE FROM COMMON ANEROID TYPE

By Charles A. Laird

IN THE fascinating study of the weather, the best way to keep track of barometer fluctuations is with a barograph, or recording barometer. This instrument traces an ink line on a ruled sheet of paper, which is changed weekly.

Barographs are costly, but with reasonable care one can be built at home. While it will not perhaps be as accurate as a delicate laboratory instrument, it will serve the purpose of an amateur meteorologist quite well.

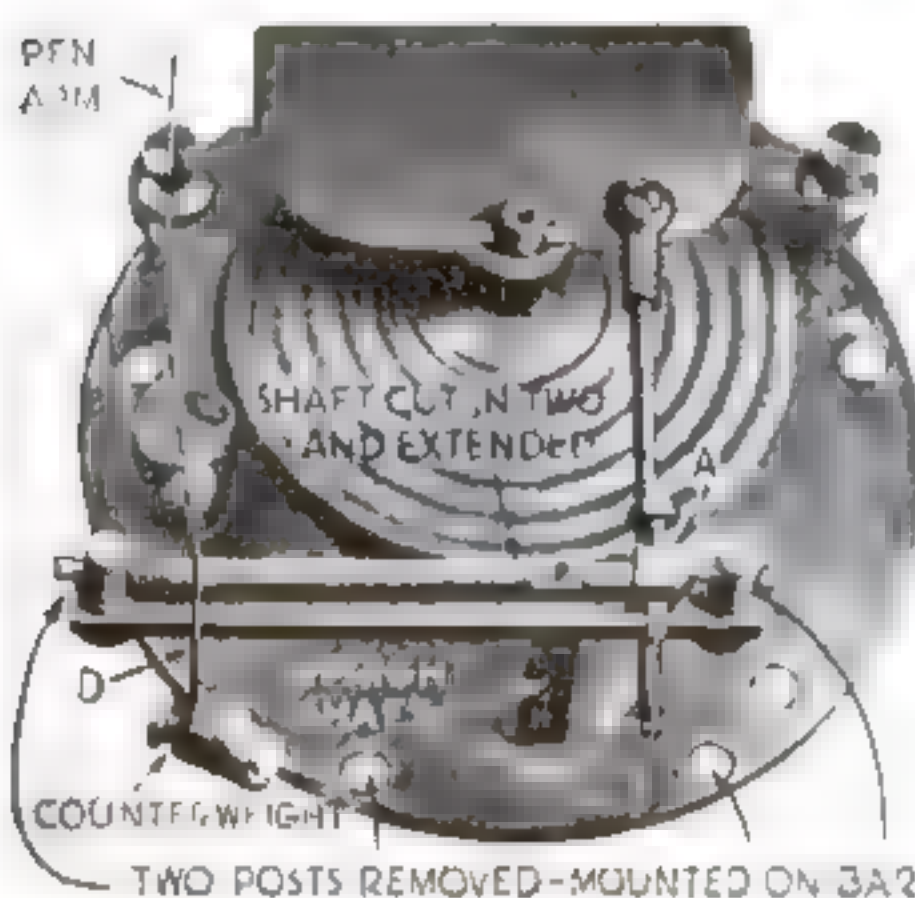
First obtain an aneroid barometer and a small eight-day clock. The barometer used in the model illustrated was bought in a second-hand store for a dollar, and the clock, taken from an old auto, cost only twenty-five cents, although it ran well when cleaned.

Cylinder. Thin brass on upright shaft. It rests on a small wheel fastened to hour-hand shaft of clock. The wheel must be of a diameter to make the cylinder turn once in seven days—or a ratio of fourteen to one, since the hour shaft turns twice every twenty-four hours. Mount cylinder and clock as shown.

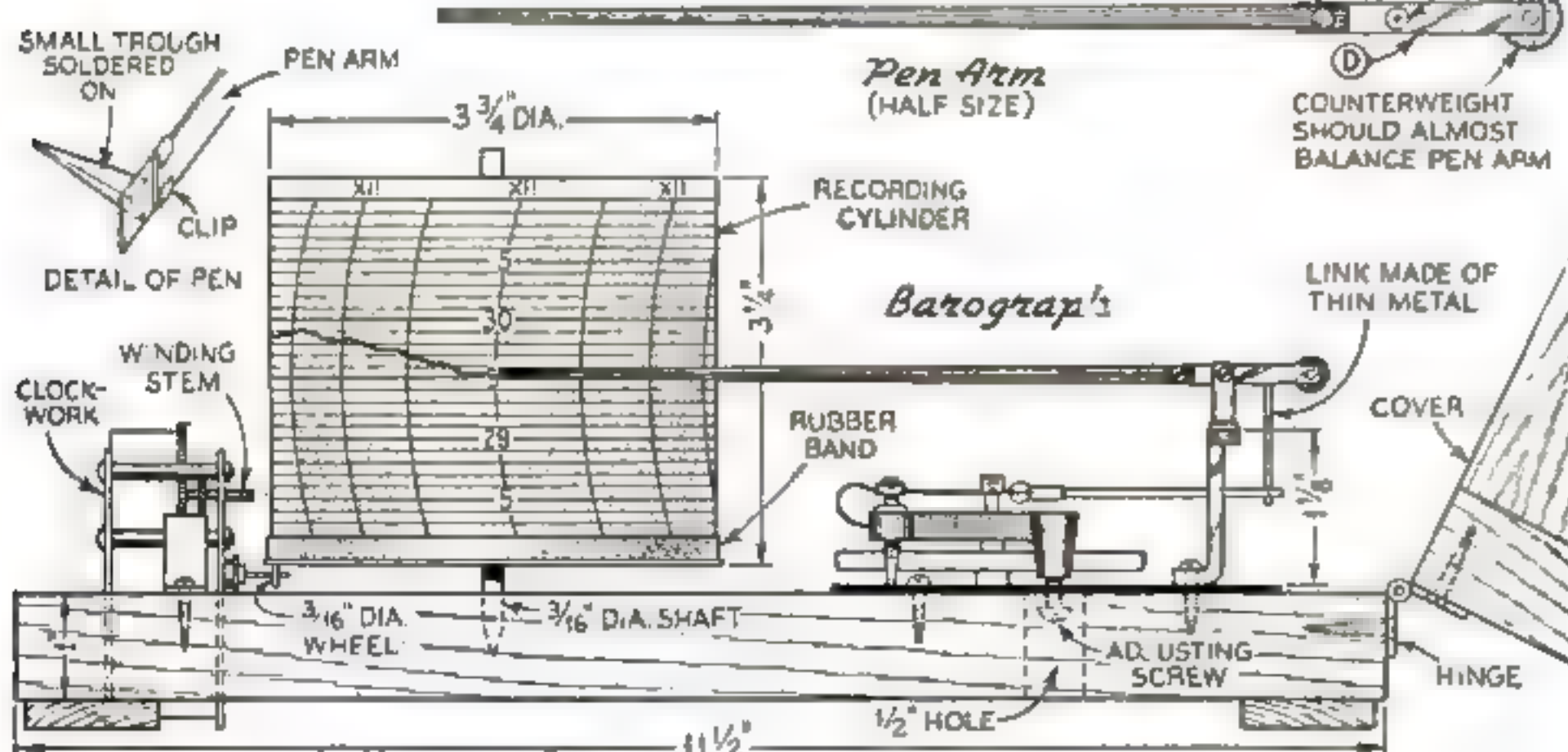
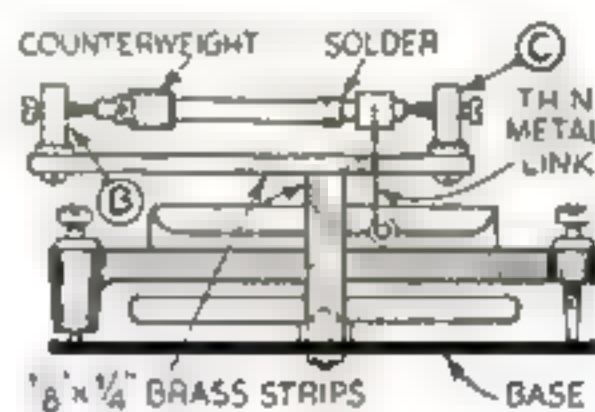
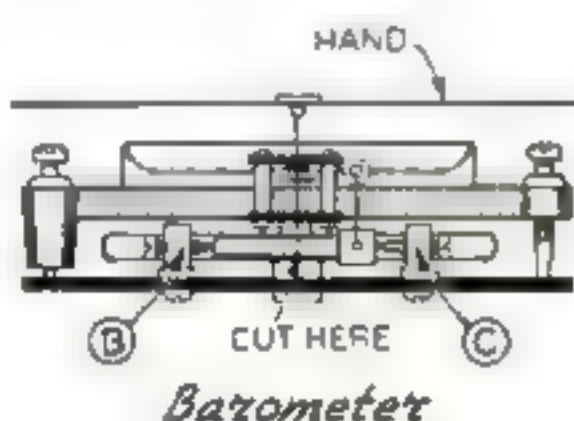
Barometer. Remove two posts (B and C) and pointed screws from back plate; also remove hand and bearing. Mount the posts on a brass strip $\frac{1}{8}$ by $\frac{1}{4}$ by $2\frac{3}{4}$ in. Solder this to an upright shaft $\frac{1}{8}$ by $\frac{1}{4}$ by $1\frac{3}{4}$ in., the lower end of which is bent 90 deg. and bolted to the base. The



A small, inexpensive aneroid barometer is altered to move the long pen arm, and the cylinder is driven by an eight-day clock



How the barometer appears when modified. The drawings at right show it before and after the changes. The complete assembly, the pen arm, and the chart are given below

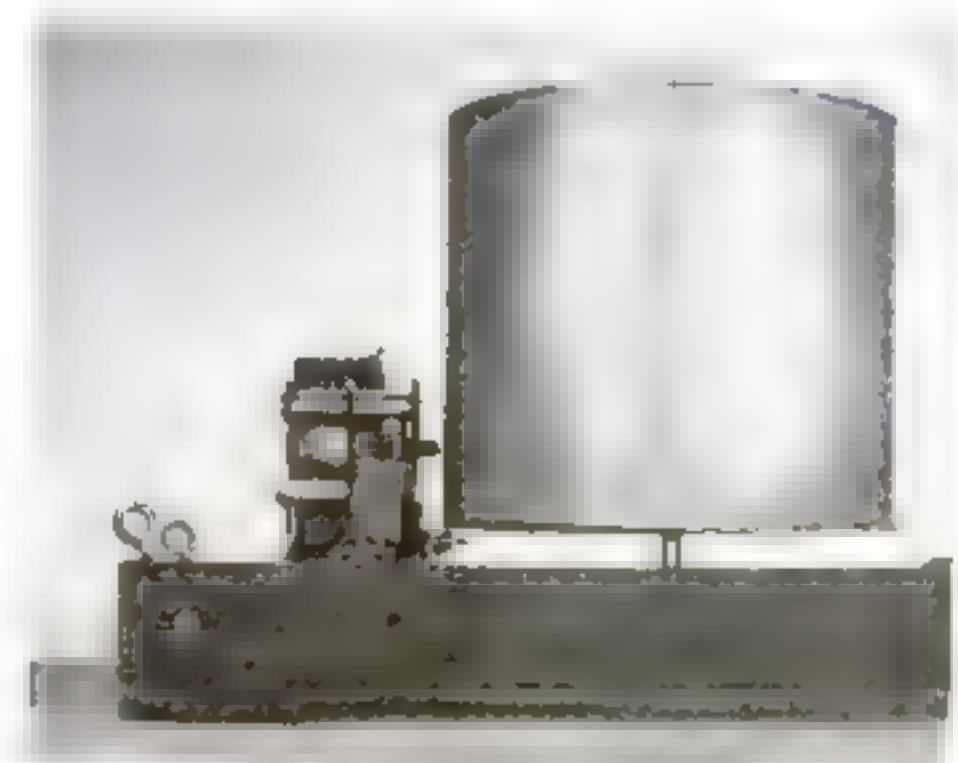
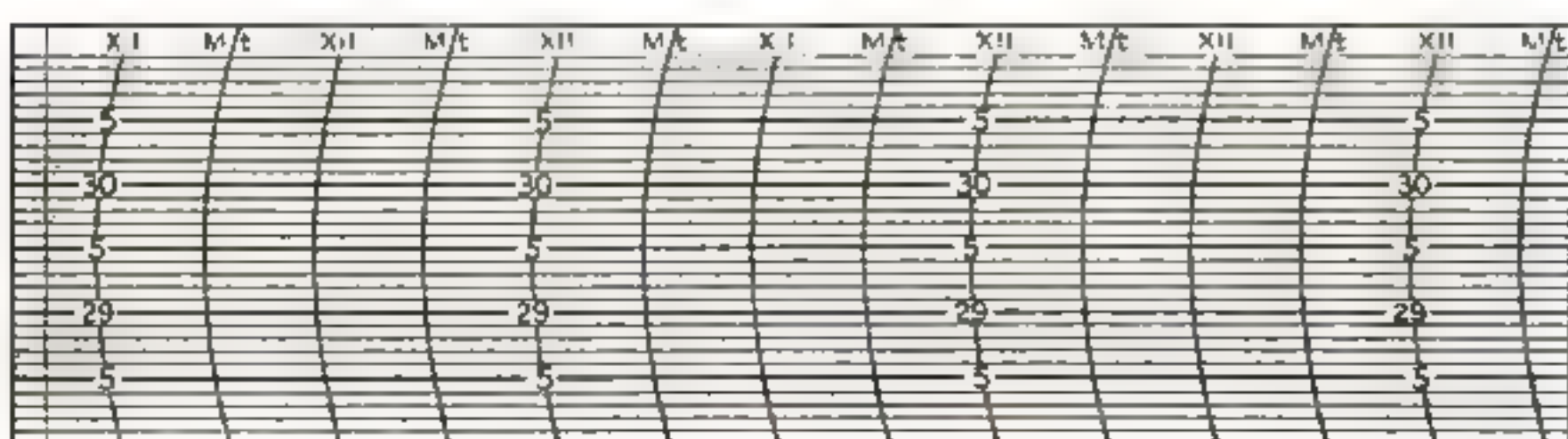


round shaft originally held between the pointed screws is cut in two and lengthened to $2\frac{1}{2}$ in. by soldering the ends in pieces of $\frac{1}{8}$ -in. outside diameter brass tubing. Mount the lengthened shaft as shown.

The small thumbscrew A projecting from one end of this shaft is used to change the length of a small lever and vary its leverage. This small lever is connected by a link of thin metal with a long lever, which extends from the steel spring on the metal vacuum box.

On the other end of the shaft solder a strip of brass D, one end of which holds the pen arm and the other end supports a counterweight. A very small movement of the vacuum box will then produce a relatively large movement of the pen arm. Regulate so a change of 1 in. in barometric pressure moves the pen arm 1 in. at its outer end.

Chart. Rule with horizontal lines 1 in. apart, and divide into tenths by lighter lines. Draw curved lines as shown for every six or twelve hours. It is well to make a number (Continued on page 124)



Above: The cylinder and clock. At left: Turning the small thumbscrew used to regulate the pen-arm movement

Comfortable Rustic Chair

MADE OF WILLOW BRANCHES

By
Elisabeth Frost Miner

BEAUTY, comfort, and outdoor durability distinguish the design of this rustic chair. The back and arms are supple willow reeds; the seat is made of flat-sided branches. For twenty years Joe Pak, of Riner, Va., has used a garden chair of this type—a demonstration of its durability.

Branches pruned from willow trees and saplings will furnish the material (see list at end of article). It is advisable to peel them.

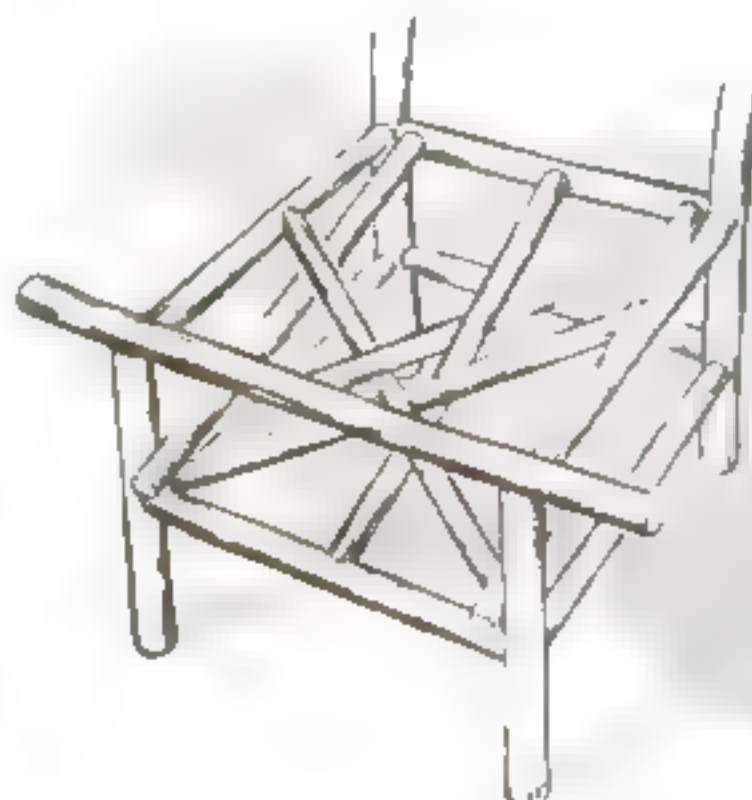
Framework. Nail three 14-in. crossbars to back legs, spaced from bottom 6, 14, and 23 in. Join front legs with one 14-in. crossbar 6 in. from bottom, and another at least 24½ in. long across top ends, extending equally on each side. Nail C and D (about 6 in. long) between the front crossbars as shown.

Connect front and back leg frames with two 14-in. long crossbars on each side, spaced like front crossbars. Brace framework with six 17-in. long pieces as indicated in the bracing diagram. Fasten a 24½-in. cross bar marked A across and in back of the front legs about 3½ in. above B, and also nail it to C and D. Nail split logs on to form seat.

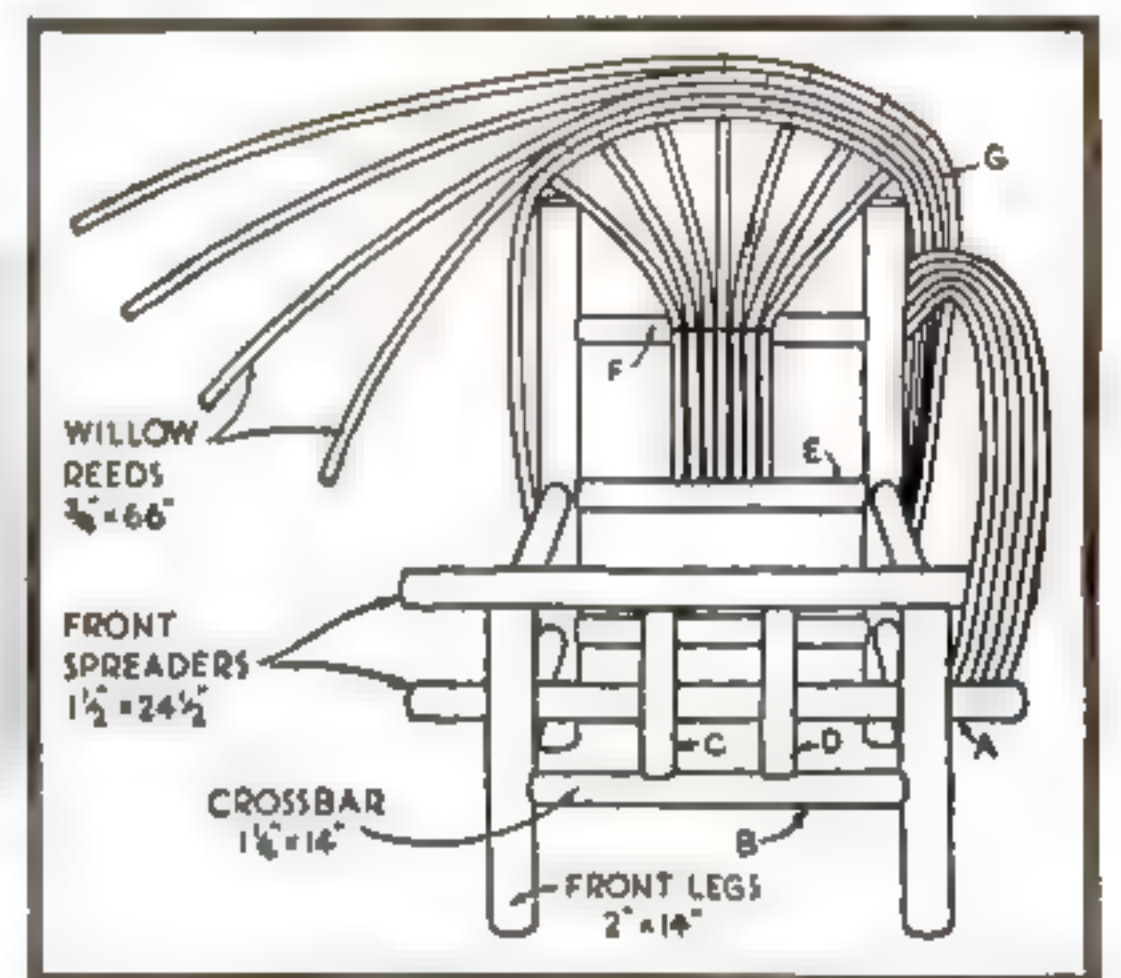
Arms. Soak willow for about twenty-four hours. Nail to side of back legs in succession, *(Continued on page 103)*



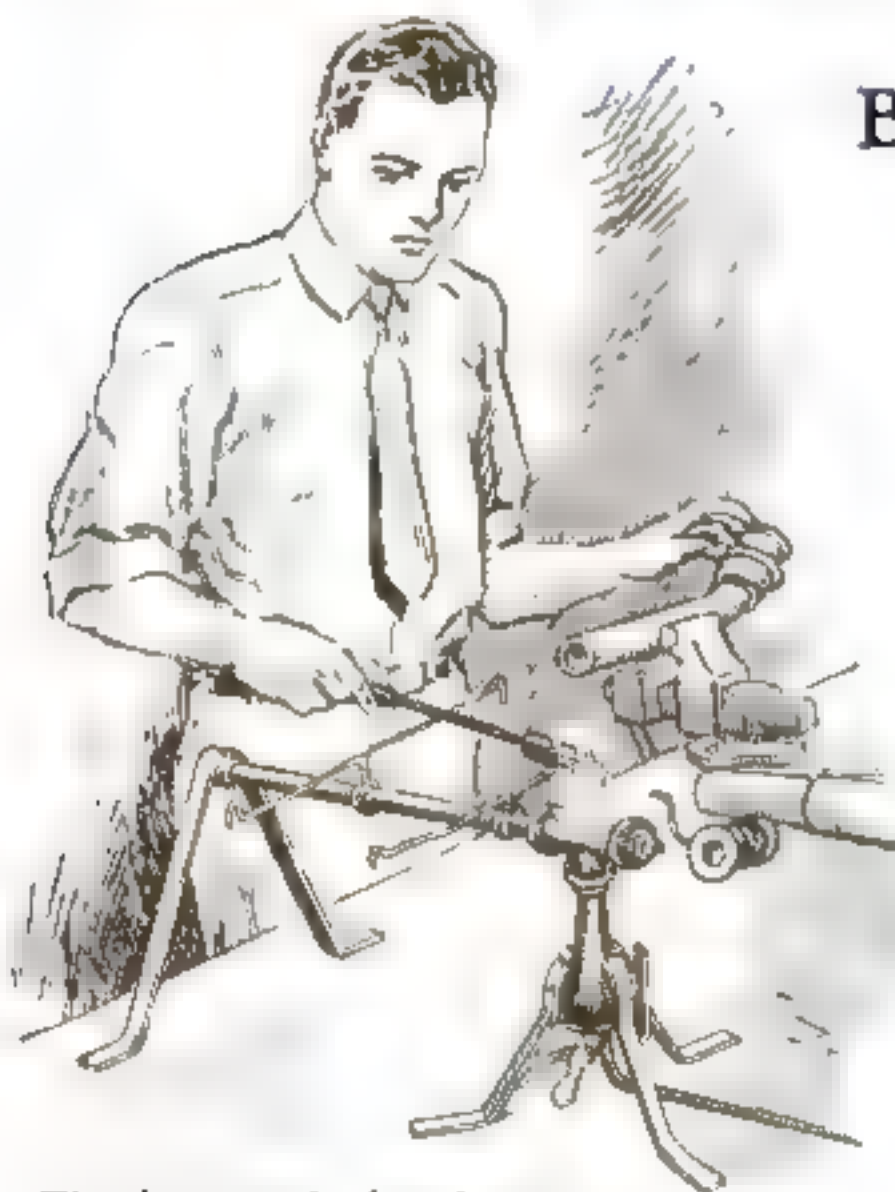
Not only is this chair unusually graceful, but back and arms are somewhat springy



How the six diagonal braces are applied (some parts of the frame being omitted for clearness) and, at right, the general plan



BENCH STOVE HAS CHANGEABLE BURNERS



The homemade bench gas stove set up with a special burner for soldering irons

A UNIVERSAL shop gas stove with interchangeable burners for various heating jobs at the workbench can be made from a burner from an old gas stove and a few pipe fittings.

Only the valve and the bell end of the burner are used. The burner itself is cut off about 3 in. from the bell end. Three legs, made from pieces of ½ by ⅝-in. strap iron, are fastened to the bell. The gas valve is held by a strap that is fastened to the bell and to one leg as shown.

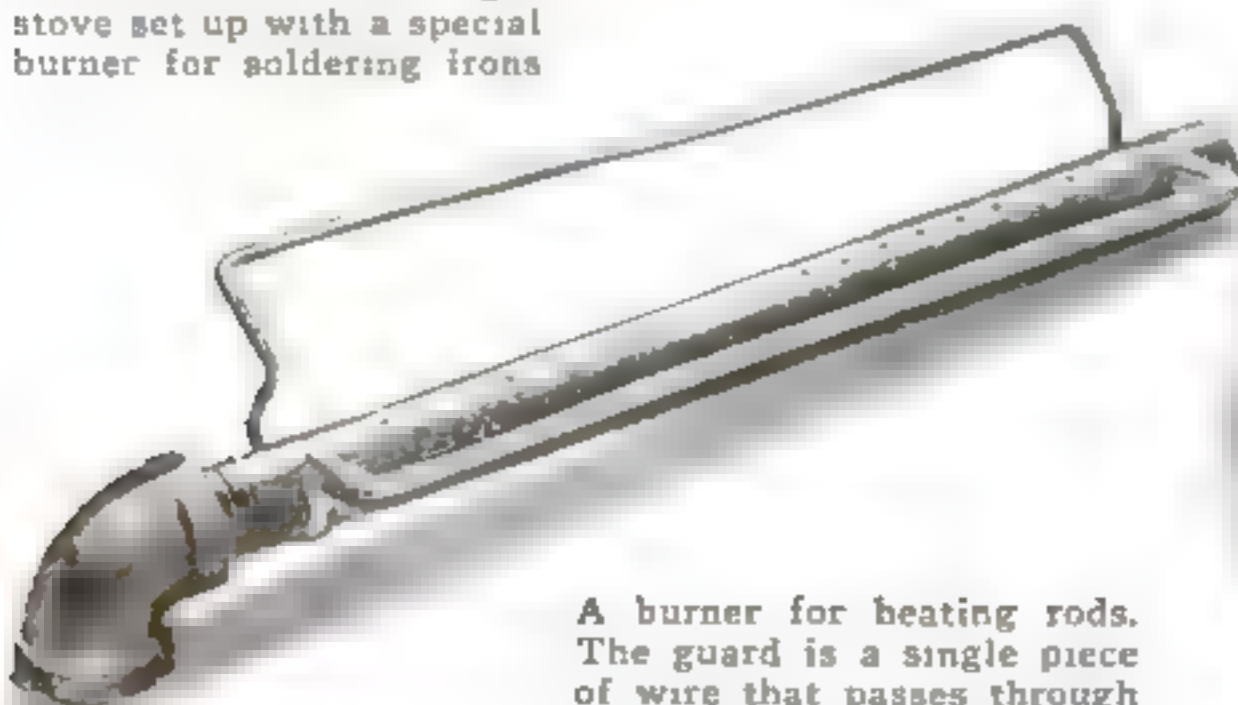
In order that the various burners may be attached to the base, a ¾-in. pipe nipple with a ½-in. bushing on one end is ground down so it will fit in the end of the burner base and is cemented to the base

with furnace cement. A stove bolt is placed in the side of the nipple and, as illustrated in one of the photos, fits into a slot in the base to keep the nipple from turning.

The general utility burner (see page 103) is made from a ½-in. pipe cap with a slot cut in each side, the ends of the slots being about ⅛ in. apart. The grate is made of two pieces of heavy wire, one of which is passed through holes drilled in the side of the cap, *(Continued on page 103)*



When the parts are assembled, the stove bolt shown above fits into a slot in the base of the burner. Left: A slotted pipe-tee burner with a rectangular wire grate



A burner for heating rods. The guard is a single piece of wire that passes through the pipe at the closed end

How to Paint Concrete Floors

By
**RALPH G.
WARING**

WITH the increase of oil burners, gas-fired furnaces, and air conditioning equipment, the basements of many homes are being remodeled. New houses are likewise being planned so that the cellar areas will become playrooms, laundries, or home workshops. The cement floor therefore becomes a real problem from both the maintenance and the decorative points of view.

Floors that have been laid directly on the dirt and constantly remain damp will require special preparation, and even those floors which are dry will need several treatments previous to being painted. A floor made with insufficient cement will be inclined to wear easily and dust freely at the surface, and for this reason must be given a wash application of a commercial hardener in order to tighten up the surface.

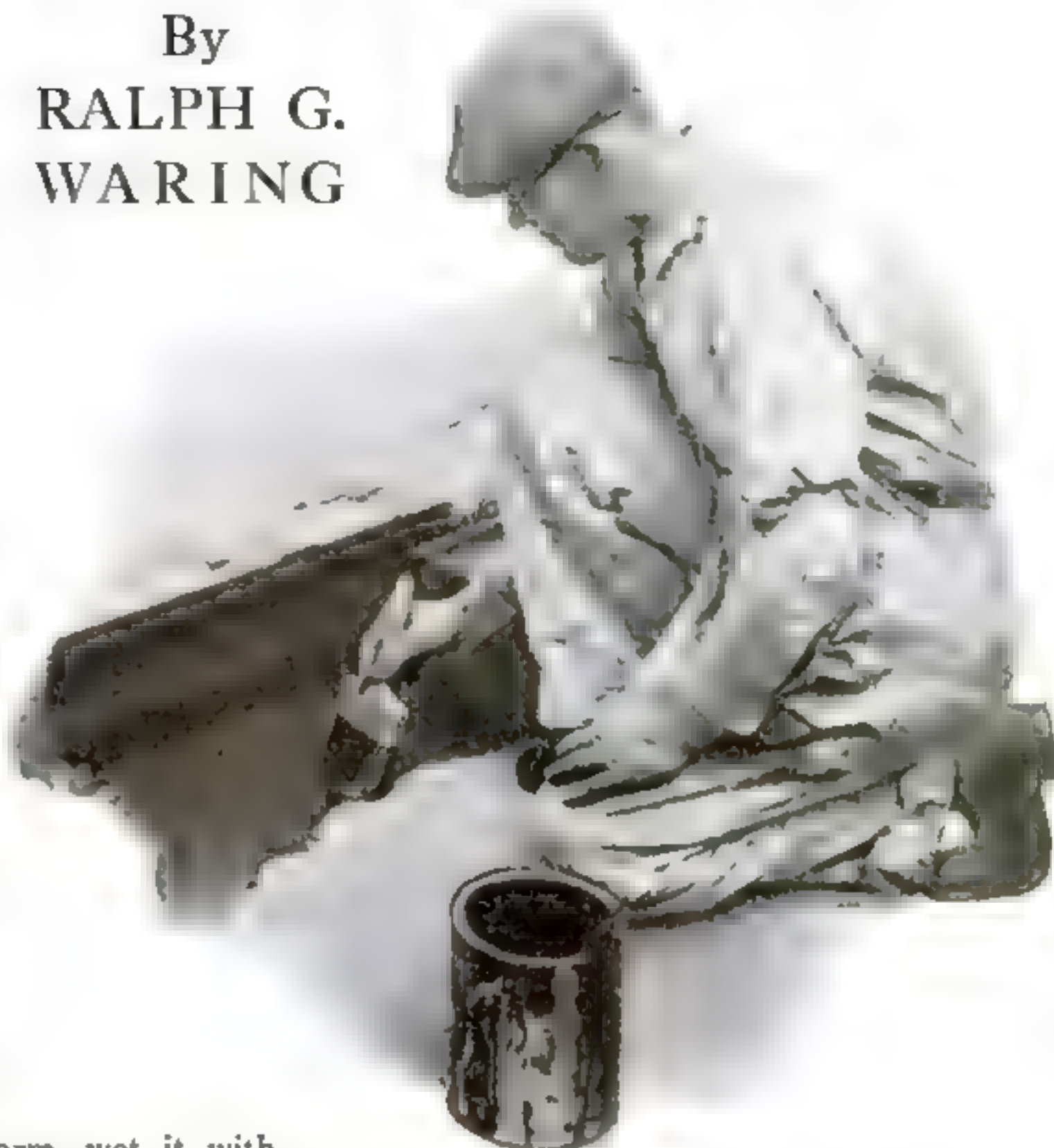
A sound, hard floor, free of cracks, may be so new that it will contain enough free alkali to render painting useless. When concrete changes from a wet aggregate to solid rock, free lime is produced. This will quickly react with the oil in floor enamel, change the oil to a soap, and in the presence of moisture, as from a floor mop, will soon disintegrate and spoil the entire job of painting. Hence it is advisable either to treat all new floors with a commercial hardener or to apply with a broom a neutralizing solution made by dissolving 3 lb. zinc sulphate in 1 gal. hot water. This is a most necessary treatment and should not be neglected in spite of any desire to save work or money. The solution reacts with all free lime available and tends to seal the surface of the concrete with a mixture of gypsum (calcium sulphate) and zinc hydroxide (hydrated oxide of zinc), both of which can be and are used as paint pigments.

For practical reasons it is best to do this work if possible when the furnace is in operation and the cellar area is as dry as it can be made. Leave the windows open a bit to allow fast circulation of air. Since dampness on concrete will prevent

good adhesion of subsequent paint materials, allow a floor treated with zinc sulphate to dry three days with heat and then test with a rubber floor mat or large piece of linoleum, laid face down. If, after three days more, no moisture or condensation is to be seen beneath the mat immediately it is lifted from the floor, the surface is safe to paint. If this test shows free moisture in the concrete, give more time and change the test location.

One of the best first-coat materials in use today is an aluminum primer made by adding 2 lb. of varnish grade aluminum powder to 1 gal. inside, quick-drying spar varnish. If the aluminum powder is furnished in the dry form, wet it with enough pure turpentine to form a paste and then stir into the varnish. This will produce a much better mix than is possible otherwise. Some paint manufacturers are offering a prepared paste in a double-compartment can ready to be added to the varnish in the bottom section. This is a convenient form in which to buy the materials. Do not use linseed oil with the aluminum powder in place of the varnish, as this would result in a soft, spongy film of little or no durability.

Apply the mixed varnish primer with a 4- or 6-in. wall brush and be extremely careful to brush it out thoroughly. Let dry a week or until very hard, then follow with a floor



enamel made for cement and of whatever color is required. The enamel should be given at least a week to harden completely, regardless of whether it is a four-hour type or not.

Where floors are old, dirty, greasy, or cracked, all cracks must be cut out with a mason's chisel and sledge, then brushed out, wet with water, and pointed up with a mixture of 1 (Continued on page 106)



DURABILITY IS INSURED ONLY BY PROPER PREPARATION

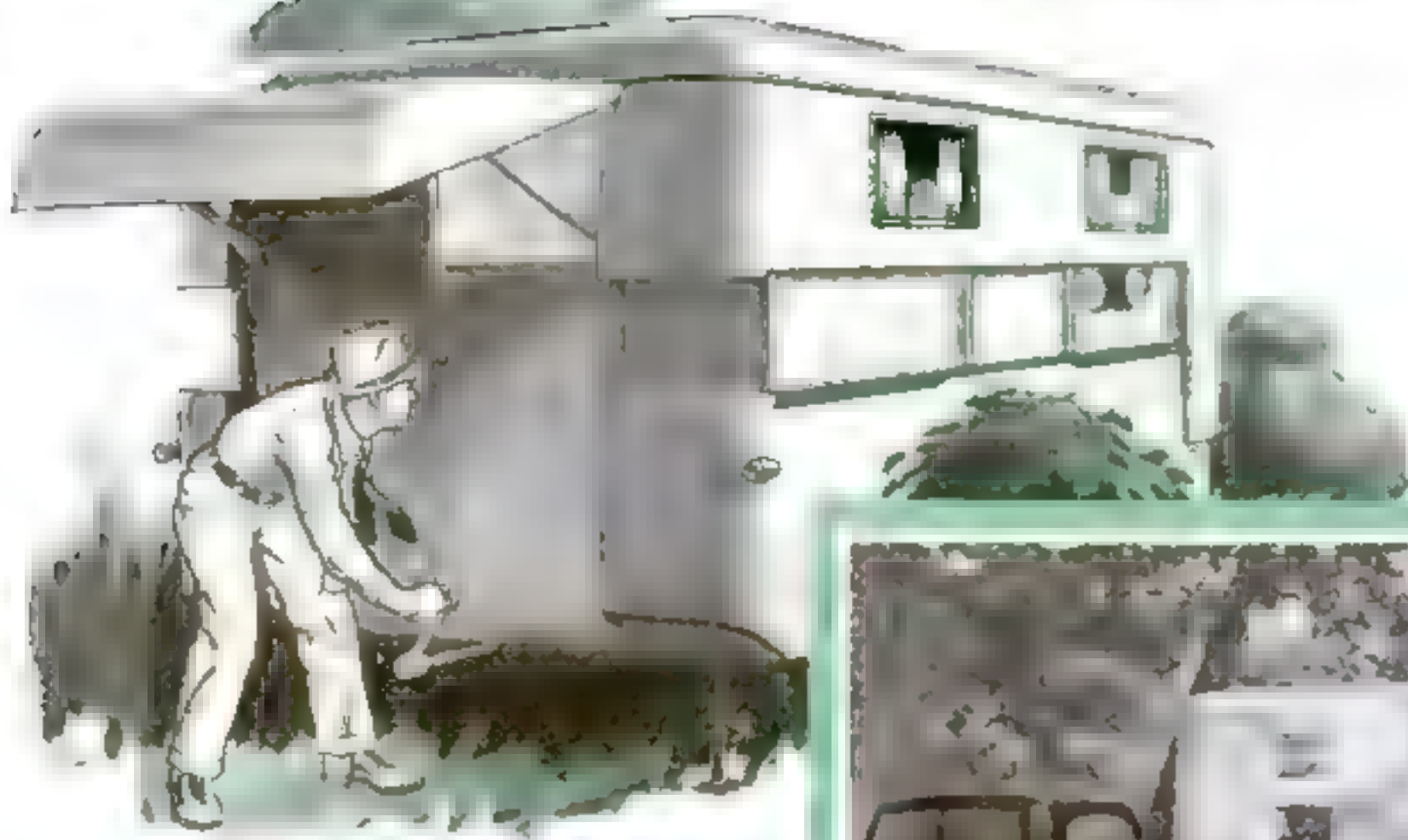
Old floors (see table at right) usually need to be scrubbed with a trisodium-phosphate solution as shown at the left. Below: Applying a brush coat of zinc sulphate to neutralize a new cement patch



FLOOR	OLD	DIRTY	GREASY	CRACKED	NEW	OLD, SOFT, BUT SOUND, GREASE FREE
POINT UP WITH NEW CEMENT	✓			✓		✓
LYE SOLUTION OR ALCOHOL AND GASOLINE			✓			
TRISODIUM PHOSPHATE	✓	✓	✓	✓		
COMMERCIAL HARDENER	✓			OPT.	✓	✓
ZINC SULPHATE	*	✓	✓	✓	*	
DRYING PERIOD	✓	✓	✓	✓	✓	✓
ALUMINUM PRIMER	✓	✓	✓	✓	✓	✓
DRYING PERIOD	✓	✓	✓	✓	✓	✓
FIRST ENAMEL COAT	✓	✓	✓	✓	✓	✓
DRYING PERIOD	✓	✓	✓	✓	✓	✓
SECOND ENAMEL COAT	OPT.	OPT.	OPT.	OPT.	OPT.	✓
SEVEN-DAY DRYING PERIOD	OPT.	OPT.	OPT.	OPT.	OPT.	✓

* USE IF NOT HARDENED

Building the BODY



Turning a crank raises the upper section of Johannes Schneider's trailer, and the rear lid is lifted to form a porch roof as at the right



Prize-winning suggestions include a telescopic design . . . packing-case walls . . . paper-pulp insulation . . . observation platform . . . canoe carrier

AFTER the chassis has been constructed, the amateur trailer builder is confronted with the problem of how to assemble the body. Many valuable ideas for this part of the work were submitted in our recent trailer contest, the winners of which were announced in last month's article (see P.S.M., May '37, p. 86).

Telescoping Trailer. Johannes Schneider won second prize with a design for a telescoping trailer. One advantage is that it is no higher than the towing car, and this results in minimum wind resistance and low center of gravity. Another is that it can go anywhere the automobile goes, which is a great help when searching densely wooded sections for an ideal camping site. When parked, the upper part of the trailer is raised to give as much as 7 ft. of headroom.

Exact details cannot be given because they will vary with every trailer, but the trailer consists essentially of an upper and a lower part, each being a solid-built unit. The upper section is raised and lowered by means of four $\frac{1}{4}$ -in. steel cables, which are simultaneously wound or unwound on two drums turned by a crank on the rear end. The drums are 2 in. in diameter with three or four threads per inch cut in for winding the cable without overlapping. There should be several more threads than required to lift the upper half into position.

The drums are bored to fit the outside of a seamless $\frac{1}{2}$ -in. pipe, which serves as the shaft. The shaft is attached to the underside of the frame members, and ball bearings are used for shaft and pulleys to reduce friction. A turnbuckle for each cable provides for adjustment. A strong ratchet and pawl are attached to the shaft.

Two guides hold the upper part of the trailer in position as shown. Sponge rubber strips placed as indicated keep the trailer dustproof and draftproof. It takes one man only $2\frac{1}{2}$ minutes to change the trailer from the traveling to the parked position and to lift the rear lid so that it

serves as a porch roof as shown above.

Packing-case Side Walls. Packing cases, obtainable for little or nothing from any electric-refrigerator agency, form the side walls of a trailer built by Thomas P. Hanford, winner of third prize. These cases are usually made of $\frac{3}{16}$ -in. plywood, and each side has a complete frame of 1 by 2-in. wood, the overall dimensions being about 36 by 65 in.

After the work on the chassis and flooring is completed, the packing-case sections are stood on end around the edges of the floor as shown on the facing page and fixed to the floor with corner iron braces. Strips of .025-in. cold-rolled steel 3 in. wide are used on the outside to fasten the sections together vertically. At the corners of the trailer, the strips are bent lengthwise to the proper angle. All are fastened with screws. A strip of $\frac{1}{2}$ by $1\frac{1}{4}$ -in. wood around the top stiffens the whole assembly.

The customary roof bows, when placed on top of the 65-in. high sides, give ample headroom. The bows are also attached with corner irons. Additional 1 by 2-in. framing is used to outline the windows. Large pieces of corrugated cardboard line the interior, although when painted they are not easily recognized as such.

Observation Platform. Designed by Harold E. Stewart, this prize-winning observation platform takes but a few minutes to set up after the trailer is parked. The floor, which is 6 ft. wide and extends $5\frac{1}{2}$ ft., is built of the same construc-

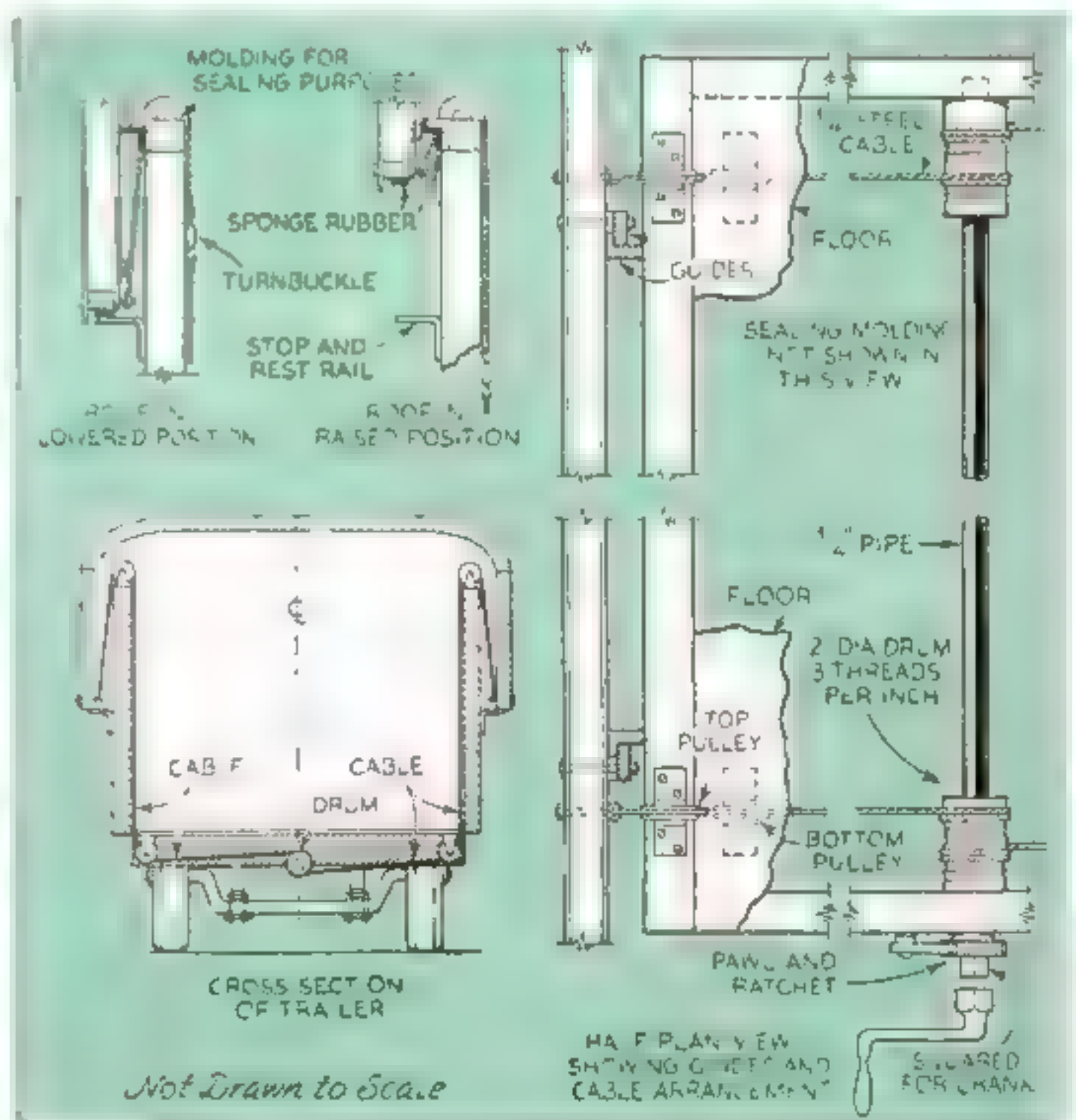
tion as used in the trailer or of thin flooring with 1-in. cleats nailed lengthwise. Small bumpers can be obtained from a junk yard or made by cutting a regular bumper in half. They are fastened to the rear end of the sliding platform as shown, and the bottom iron of the railing is bolted directly to the bumper brackets. The railings are built from 1-in. outside diameter conduit pipes, which are welded between two 2 by $\frac{3}{8}$ -in. flat iron pieces bent so that they go around the corners

and fit inside the bumpers. Holes are drilled and tapped in the top irons directly above the end pipes to take $\frac{1}{4}$ -in. bolts, holding the wooden knobs in place.

The channels for the platform to slide upon are made from oak as shown. The spacing piece should be slightly thicker than the floor.

Then pieces of 1 by $\frac{1}{4}$ -in. flat iron $2\frac{1}{2}$ ft. long, with ends rounded, are used for the telescopic side rails. They are fastened together with rivets, and the bottom of each end piece is slotted to slide up and down. Two heavy screen-door hooks hold the section in place while traveling.

The four uprights holding the canvas are bolted to the inside of two rods in each railing, and another pipe 6 ft. long is welded across. Short pieces of iron



Diagrams showing how the mechanism of the telescoping trailer is arranged. The four cables are wound on two threaded drums

of Your TRAILER

welded to the ends hold the 1-in. wooden roller. There is a small iron crank at one end to wind up the canvas, and a peg is inserted to keep it from unwinding. Any lightweight awning cloth can be used. It is held to the trailer by a hardwood strip fastened with screws.

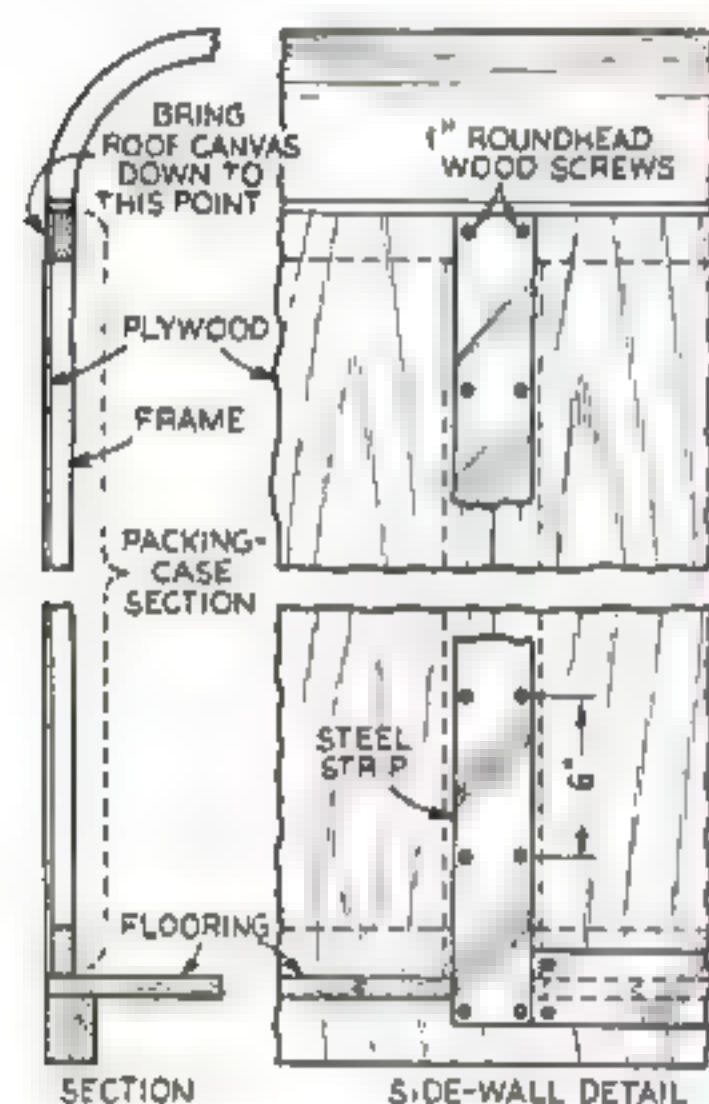
A folding leg is needed on each side of the platform, and a step may be added in the center.

Back Door for Canoe. Norbert O. Bloedorn won a prize for his idea of building a door in the back of his trailer so that a canoe or small boat may be carried inside. A suggested arrangement is given in one of the drawings.

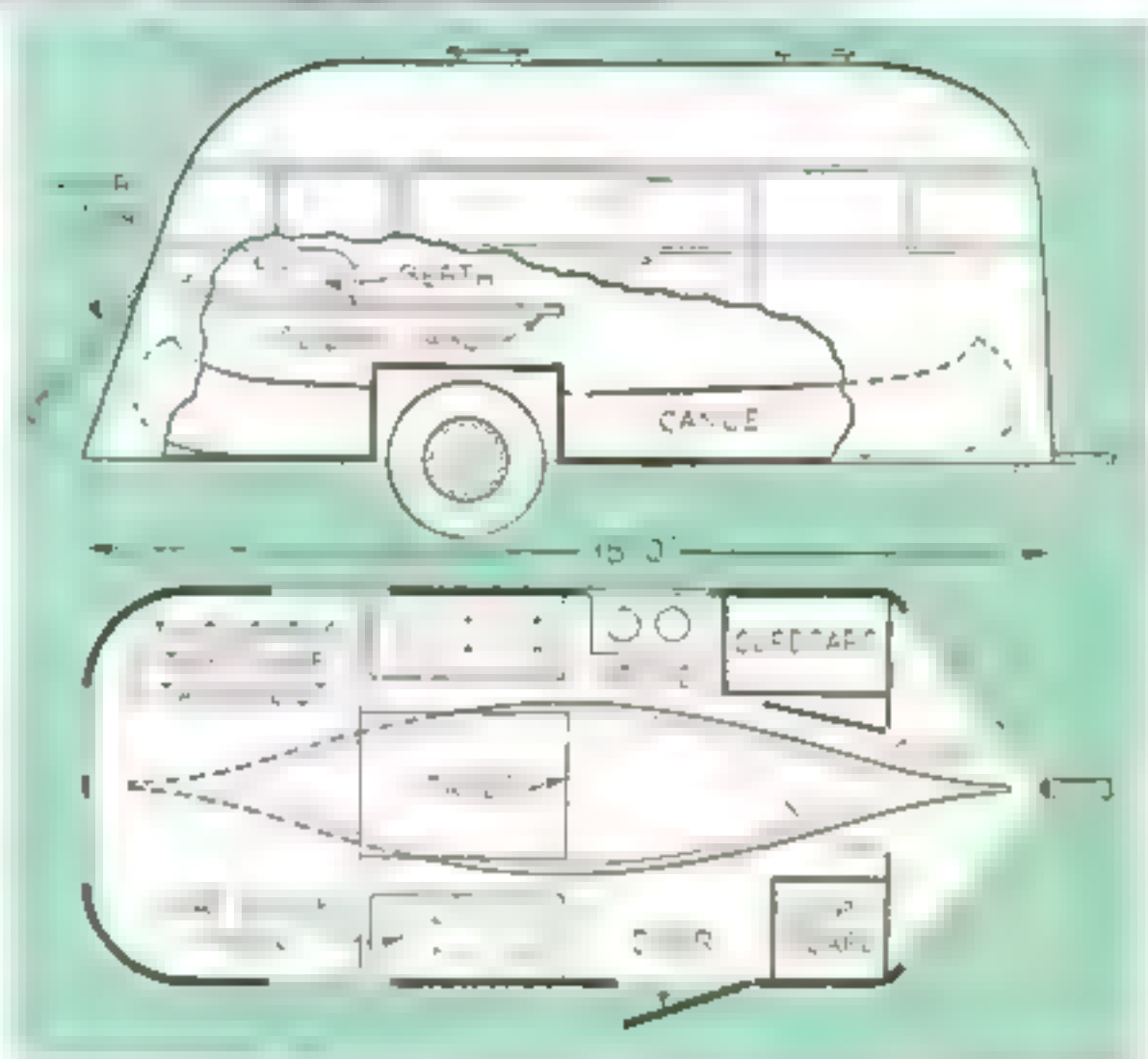
Insulation for a Metal Wall. Sheet metal is an ideal covering for many trailers since it is easily mounted, wears well, is strong yet inexpensive, and takes an excellent enamel finish. There are two objections—its lack of insulating effect and its tendency to rattle—but these points



Trailer constructed by Norbert O. Bloedorn with a door in the rear so a canoe or boat may be carried



Plywood packing cases were used to keep down the cost of this roomy trailer. The wall construction is shown above, along with an interior view; the exterior appears at right.



Side and plan view of Bloedorn's trailer, showing interior arranged to carry a canoe

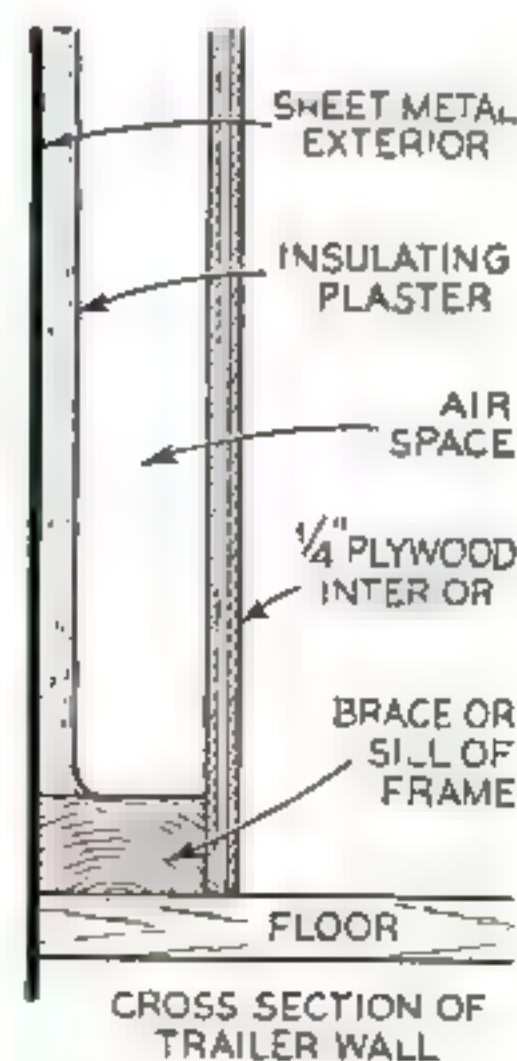
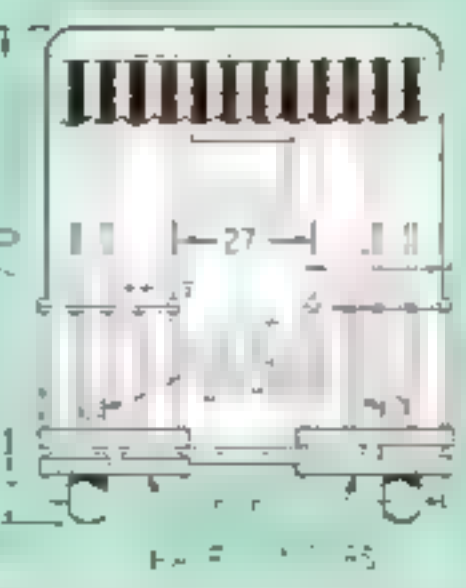
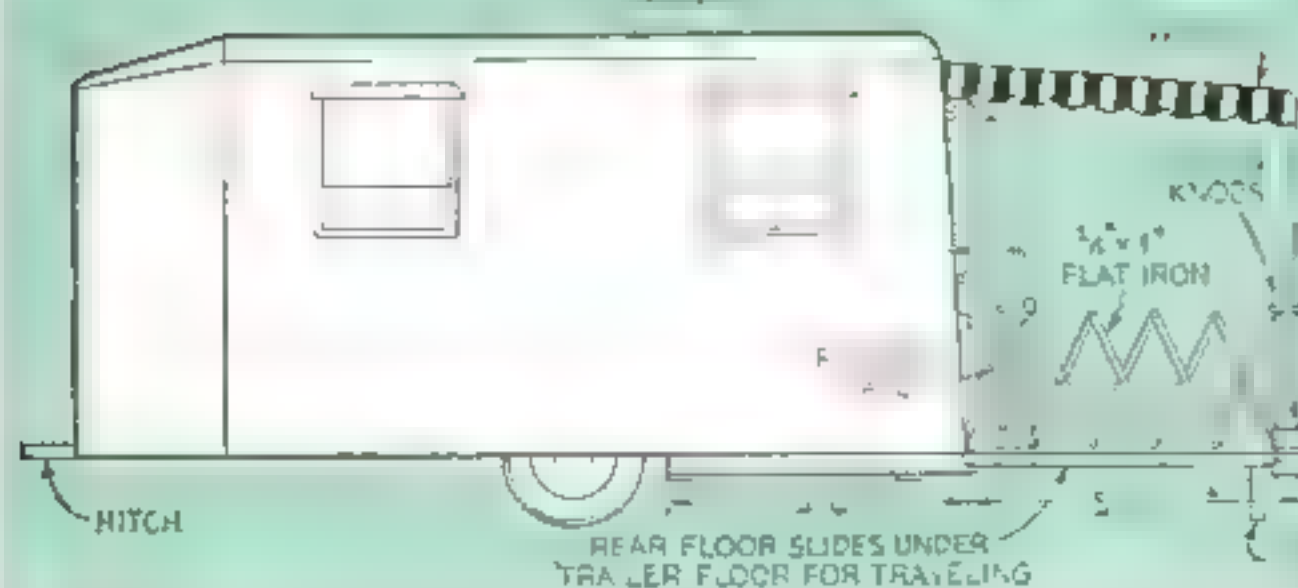
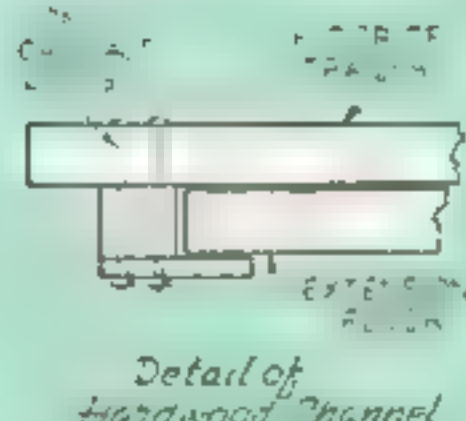
were overcome by F. E. Snider, who won a prize with his method of insulation.

Make a paste from scrap paper such as cheap pulp magazines (not the slick, non-porous type) or newspapers. Tear them into small bits and soak in enough water to moisten them. If too much water is added, press it out. Let the mass soak for

several days; then bring nearly to the boiling point and add 2 or 3 oz. of powdered glue for each gallon of pulp.

Plaster this pulp on, working from the bottom up. About 1/4-in. thick is usually satisfactory. Allow to dry slowly in the shade. If the trailer is to be used in a very damp climate, spray the pulp with a waterproofing paint. One gallon of paste will cover about 6 1/2 sq. ft., 1/4 in. thick.

(TO BE CONCLUDED)



Paper pulp applied to walls as an insulation

Observation platform with sliding floor, telescoping side rails, and an awning that winds up

AMAZING NEW Flight Bow

PULLS INSTEAD OF PUSHES THE ARROW



Hill shoots 160 yards with this miniature bow, the pull of which is only ten pounds. The arrows go inside the barrel and are pulled by the string

USING what I term a "double-action" bow and a "front-wheel-drive" arrow of entirely new design, Orville Littleton and I have obtained almost incredible results in a series of flight-shot experiments. Here are the figures:

BEST TYPE YEW FLIGHT BOW

10-lb. bow, 28-in. Port
Orford cedar arrow... 60 yd.
30-lb. bow, 28-in. Port
Orford cedar arrow... 209 yd.
65-lb. bow, 28-in. Port
Orford cedar arrow... 304 yd.

BOW AND ARROW OF NEW DESIGN

10-lb. bow, spring type,
front-drive arrow... 160 yd.
30-lb. bow, spring type,
front-drive arrow... 328 yd.

The term "30-lb. bow" means that a pull of 30 lb. is required to draw back fully whatever length of arrow is intended to be used with it. Note therefore that the new 30-lb. bow and arrow gave a greater flight than a 65-lb. bow of the finest type heretofore developed for flight shooting.

Conventional arrows are difficult to make successfully, but those used with the new bow, which are pulled instead of pushed, are simplicity itself—a piece of squared umbrella rib, a nail, and a sliver of bamboo. The new double-action bow is made like other bows, but three

By
**HOWARD
HILL**

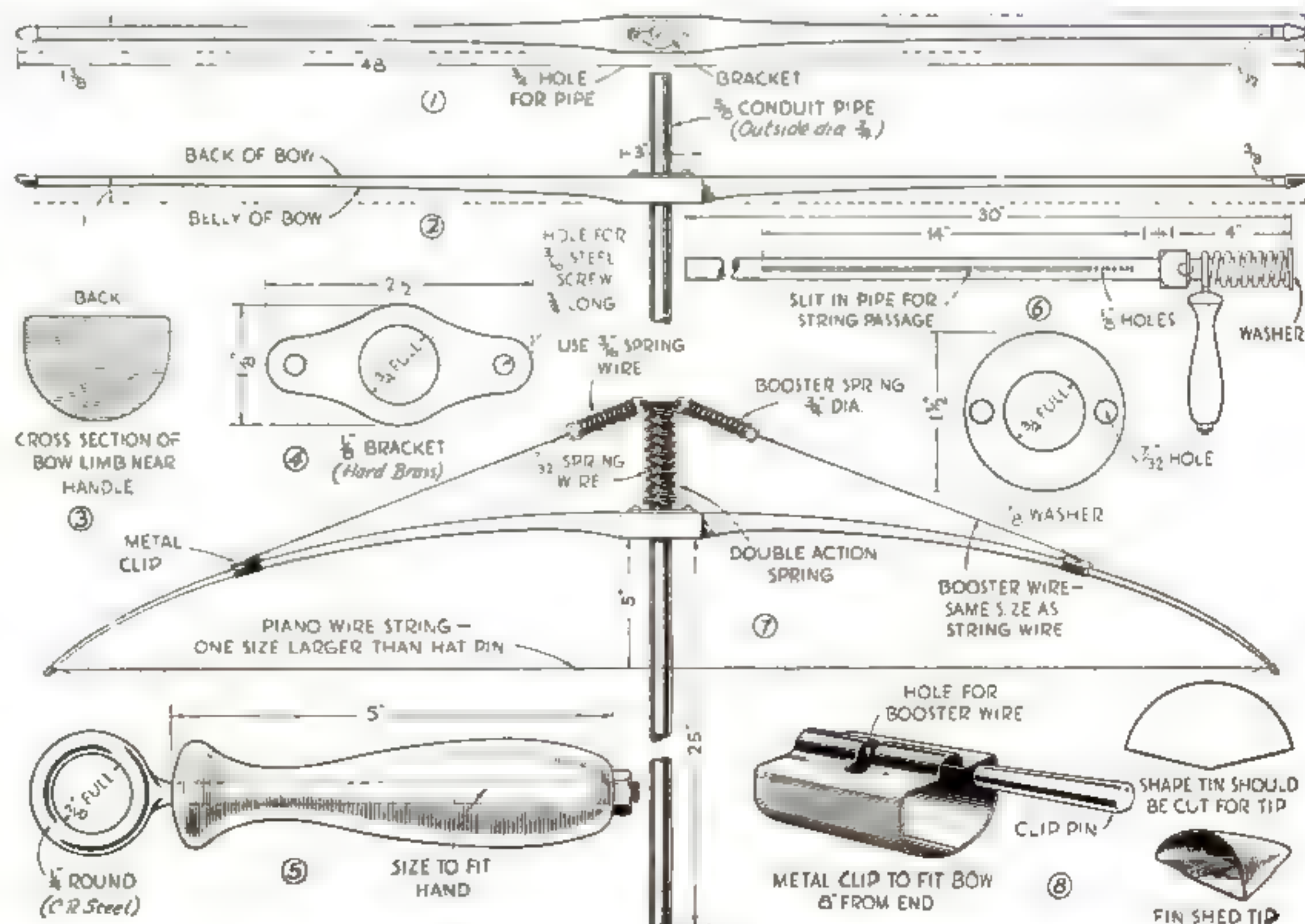
Famous archer and formerly holder of world's flight record

springs and a few other parts are added.

I am convinced that the new equipment also offers something better for target shooting as well as flight shooting; however that remains to be worked out.

The Bow. Use lemonwood stave 1 in. thick, $1\frac{3}{8}$ in. wide, 4 ft. long. (Experienced workers may use yew or osage orange.) Smooth the back. Draw center line as in Fig. 1. Leave 3-in. section in center the full width and thickness of stave. Draw four lines on back as shown and plane stave to shape. Turn stave edge up, lay out as in Fig. 2; then work to lines with plane, spokeshave, and scraper. Cut temporary nocks with a rat-tail file, brace the bow with a strong temporary string, and pull it a few inches to see where there are any stiff sections. Work them down to the cross section shown in Fig. 3 and continue testing until the two limbs bend in perfect symmetry, inch for inch, beginning on each side of the handle section and continuing to the end of each

(Continued on page 123)



A bow with a pull of thirty to forty pounds. The handle slides on the barrel back of the large spring



Lakeside Homeworkshop Club members watch a wood-turning demonstration by Forrest Haines in the Bunker Junior High School, Muskegon, Mich.

HERE'S WHAT A



Official Magazine
POPULAR SCIENCE
MONTHLY

Home Workshop Club

IS REALLY LIKE



Carving by Albert Nadeau, of the club in Edmundston, N.B., Canada

PERHAPS you have wondered what a home workshop club is like. How many men and women belong to the average club? How much are the dues? How often does the club meet, and where? Does it have its own workshop? Is an exhibition held each year? Do the members merely make things for themselves, or do they use their hobby to help others?

These and many other questions could not be answered before, but now the National Homeworkshop Guild has completed a survey of the entire field. The facts obtained, added to those previously discovered about individual home workshop owners (P.S.M., Feb. '36, p. 60), form a complete picture of the American home workshop.

The average home workshop club has 23 members. No club recognized by the Guild can have less than five members, and the survey found that the highest membership was 343. Reports showed that 76 percent had definitely increased their membership during the past year.

Most of the clubs charge dues, and these vary from 25 cents to \$7.80 a year. The average is about \$1.80 for each member a year, not including the clubs (21 percent) which charge no dues. The latter are sup-

ported by hardware stores, or take up an occasional collection for outlays, or meet in members' homes and have no expenses. No dues whatever are collected by the National Guild itself from the affiliated clubs.

Meetings are held monthly by 42 percent of the clubs, semimonthly by 36 percent, weekly by 17 percent, while 5 percent hold several sessions a week. Clubrooms are owned by 13 percent; 38 percent meet in members' homes; 18 percent in schools, libraries, Y.M.C.A.'s, and other public places; 10 percent in hardware stores; 11 percent in a certain member's workshop; and 10 percent have several meeting places, including stores, workshops, schools, and homes.

If the club has its own workshop, the average equipment consists of three power tools, an assortment of hand tools, and several benches.

Woodworking is the most popular activity among the clubs, model making is second, metal working third, and photography fourth.

Most craftsmen (*Continued on page 96*)

Survey by the Guild yields facts about membership, meeting places, shops, exhibitions, and various other activities . . . Woodworking is the most popular hobby

These Novel Boating Ideas.



Coming in with the wind. The sail is shaped something like the Marconi rig of a cup yacht

EASILY MADE DOUBLE BIRD-WING SAIL IS SPEEDY RIG FOR SMALL BOATS

ALTHOUGH it cost only \$1.65 for materials and is used on a 15-ft. flat-bottomed rowboat, the double bird-wing sail illustrated is so efficient that few boats on Casco Bay, Me., are able to touch mine when running before the wind. In tacking and beating to the windward, the boat also does surprisingly well, although several boatmen have told me, "You can't sail a rowboat with a rig like that!"

Without gaff, boom, or halyards, the sail is the safest, the most easily handled, and the most perfect from an aerodynamic standpoint of any I have ever seen. It can be furled, unfurled, or reefed to any size in a fraction of the time required with conventional rigs. The sail is simply wound or unwound. I never got to the point of having the mast itself turn by means of a crank, but that improvement probably would be well worth the extra work. One of the most interesting features is that in sailing with the wind the ordinary sail area can be instantly doubled, an obvious advantage over the use of spinners or other extra sails.

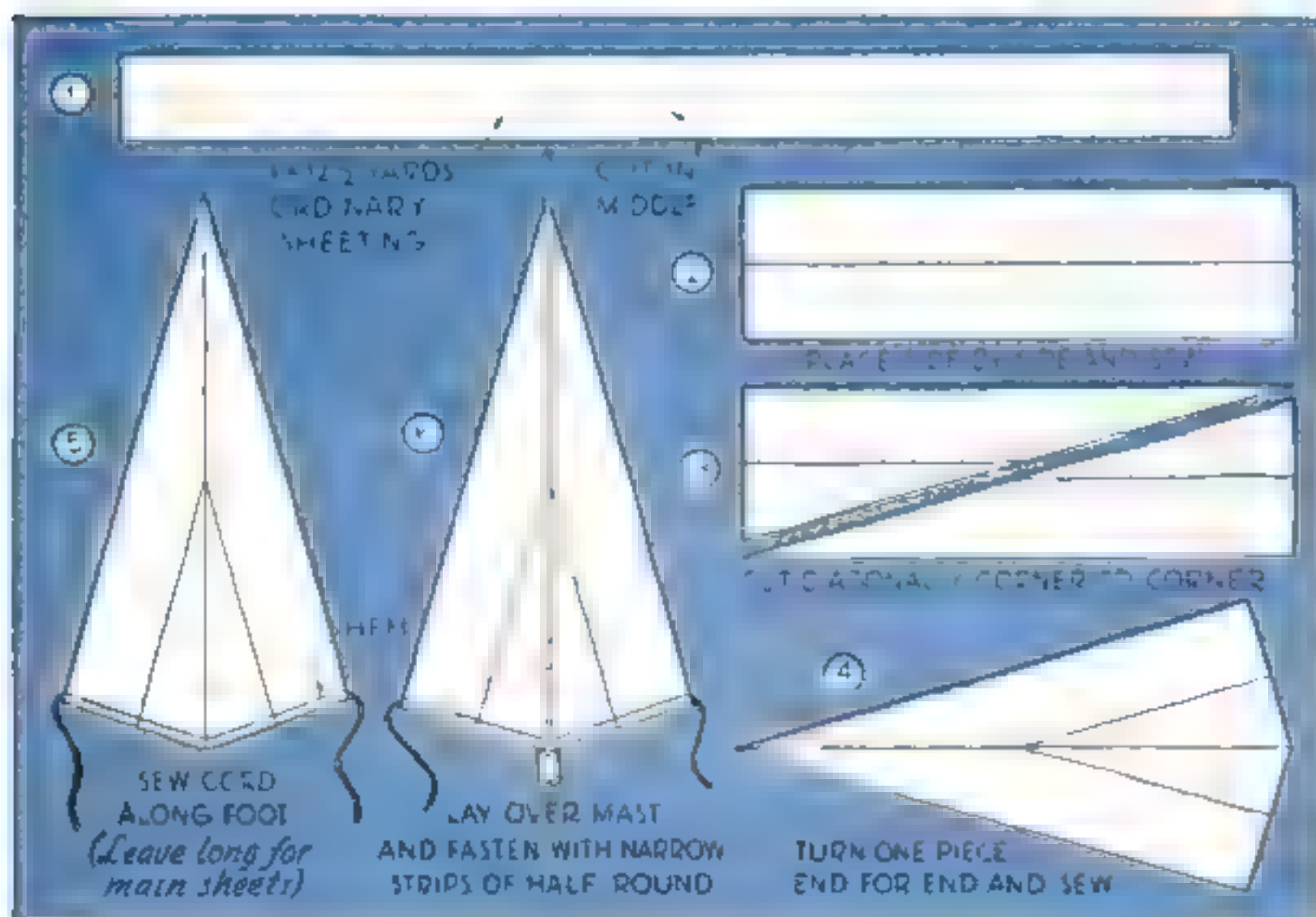
Incidentally, the sail, if not made for too large a boat, serves as an excellent overnight tent when set up as shown at the right below.

The only change made in the boat was to add a centerboard box, an oak "dagger" board, and a rudder. The location of the mast, the size and position of the centerboard or keel, and the proper ratio of height to foot of sail have to be worked out experimentally. They rarely all come right the first time; at least, they didn't in my case. I thought the sail was too big, but because it is narrow and has very little weight aloft, the boat carries it handily even in weather that keeps other small craft at anchor or under reefed sails. It could be a quarter or a third larger. That is why I added a jib I happened to have. The use of the jib made four cod-line stays necessary, but if the sail were the right size I should do with-

out the jib and possibly dispense with all stays except the backstay.

In running with the wind almost on the quarter, I use an oar to hold out the sail on the windward side. It might be well to have the wide hem on the foot of the sail open at the end so that a stick could be inserted to act as a temporary boom. This is the only case where the lack of a boom might seem a disadvantage.

The sail is 19 ft. high and 12 ft. along the foot when open. The sheeting (12½ yd. were required) was cut and sewed in half a day.—WILLIAM ROBERT LOMBARD.



Left: How sail is made. Above: The sail is furled by winding it around the mast. Right: It can be turned into an overnight tent in short order



Will Add to Your Sport

OUTRIGGER GIVES CANOE STABILITY

EMPLYING the principle of the Hawaiian outrigger, this pontoon will double the utility of your canoe. It makes the canoe absolutely tip-proof and gives a wide margin of safety on rough water and for fishing. If you sail, it provides stability enough to double the usual sail area.

The outrigger was designed for use with a canvas canoe of the kayak type made from **POPULAR SCIENCE MONTHLY** plans Nos. 192, 193, 194-R (P.S.M., Sept., Oct., Nov., and Dec., '32). It is, however, an equally valuable accessory to any canoe, and no adjustment or alteration is necessary.

Make the frame of spruce, with the exception of the stems, which are oak. Use waterproof casein glue at all joints, and drill and countersink for all screws. Saw the keel, deck strip, and four longerons from an 8 ft. board, $\frac{3}{4}$ in. thick. The keel and deck strip are identical— $\frac{3}{4}$ by $\frac{1}{2}$ in. by 7 $\frac{1}{2}$ ft. The longerons are $\frac{3}{4}$ by $\frac{3}{8}$ in. by 8 ft.

Cut out the stems, and taper and rabbet them as shown. Saw out the three bulkheads from box ends. Fasten stems and bulkheads to keel, using glue and $1\frac{1}{4}$ -in. No. 5 brass screws.

Lay the keel on a plank or other flat surface. Place a $\frac{1}{2}$ -in. thick block of wood under each end, and weight the middle down. While in this position, screw the deck strip to stems and bulkheads, to secure a rise; and fasten longerons to bulkheads with $1\frac{1}{4}$ -in. No. 5 brass screws. Trim ends of longerons to fit rabbets on stems, and fasten with 1-in. No. 4 brass screws. Fit uprights (a pair of shelf brackets, 7 by 9 in.) to stems, but do not attach until after covering. If the freeboard is small, fasten long side of brackets to the stems. Give the entire frame two coats of spar varnish and let dry.

For the covering, use a strip of thin duck (about 6-oz.) 30 in. by 8 ft., water-

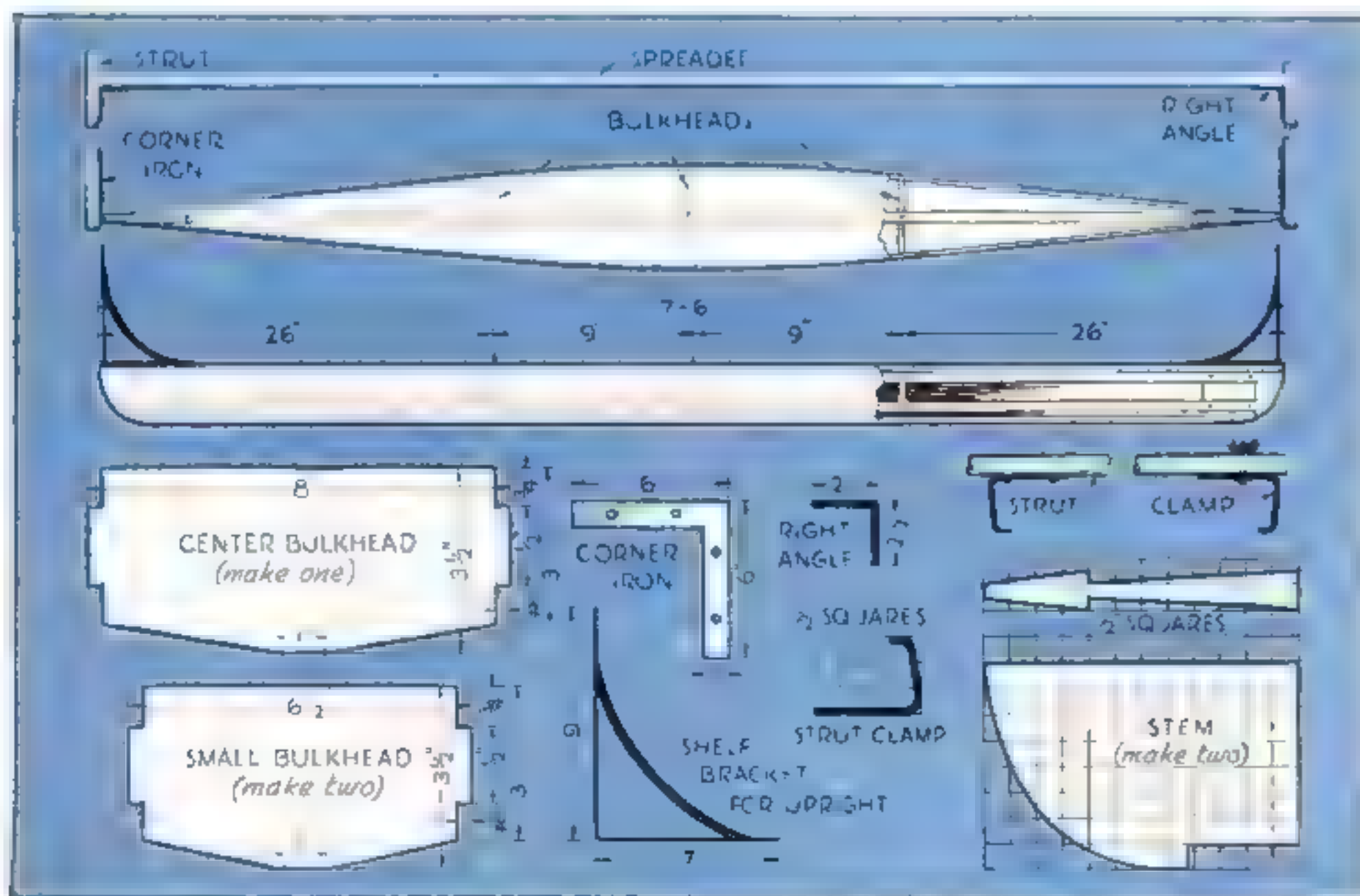
proof glue, and $\frac{3}{8}$ -in. copper tacks. Coat keel with glue, and stretch center of cloth tightly along it, fastening with as few tacks as possible, as these are later to be removed. Coat deck strip with glue, stretch one side of cloth over it tightly, and tack

every 2 in. Do not trim too close. Coat this seam with glue and stretch remainder of cloth over other side of frame, tacking to deck strip with tacks staggered every $\frac{3}{4}$ in. Trim cloth neatly $\frac{1}{4}$ in. from tacks, and glue down smoothly. Then remove the temporary tacks from the keel.

In closing the ends, stretch tightly to avoid any sags. Use plenty of glue, and tack as closely as possible, trimming close to the tack heads. After glue is dry, spray water on the cloth, causing it to shrink even tighter.

Three coats of paint, brushed well into the weave of the cloth, are sufficient for waterproofing. Use fine sandpaper to smooth after the third coat, and finish with two coats of high-grade enamel.

Struts are 1-in. hard pine dowels at least 5 ft. long. Bend clamps from 4 by $\frac{7}{8}$ -in. steel mending plates. Shape as in the drawing, making them large enough to fit the canoe gunwales snugly. Attach as shown with 1-in. No. 8 steel screws, and $1\frac{1}{2}$ by $\frac{3}{16}$ -in. bolts with wing nuts. Using screws of the same size, attach corner irons to strut. Connect struts to spreader, which is $\frac{3}{4}$ by $\frac{3}{4}$ in. by 7 $\frac{1}{2}$ ft., with small right angles and No. 4 screws. Screw uprights to pontoon with 2-in. No. 8 screws, and bolt to corner irons. Stain, varnish, or enamel both the struts and the spreader.—ZUSSMAN FREEMAN.



The assembled pontoon; bulkheads, stem, and other details; and struts, clamps, and spreader

Graceful Wrought-Iron Hanging Lamp



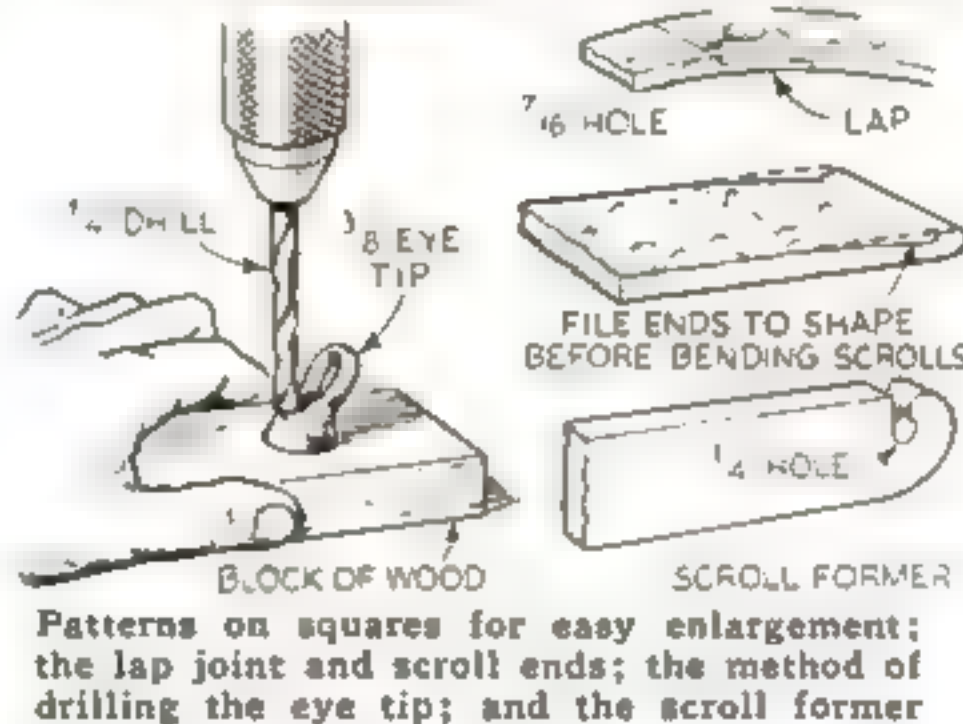
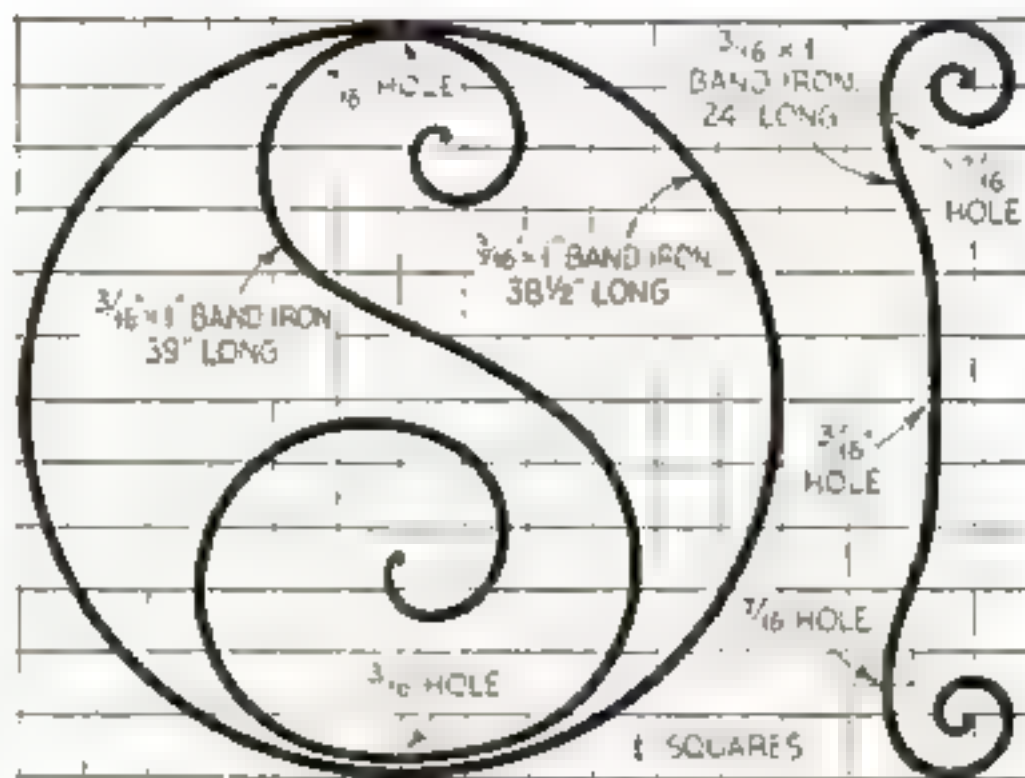
Assembling framework of the lamp, which is made from three pieces of plain band iron

WROUGHT-IRON work such as the hanging lamp illustrated may be produced in the home workshop so as to compare favorably with early English and Italian examples of the art.

The lamp is adaptable to a summer cabin, sun porch, or small living room having some Spanish or Italian furnishings. The iron materials are available at the average well-stocked hardware store, and the electrical fittings may be purchased from any electrical dealer.

First hammer the metal on all sides with a ball-peen hammer; then straighten where necessary. Prepare full-size drawings to aid in the bending operations. While the iron may be bent cold, the ends of the scrolls will bend much easier if heated red-hot. A furnace, wood stove, or blowtorch will provide the heat.

A forming tool made as shown from a piece of iron about $\frac{1}{4}$ in. thick will aid in making uniform scrolls. Drill a $\frac{1}{4}$ -in. hole in the iron and complete the shaping with a hack saw and files. A monkey wrench or U-bolt clamped in a vise will serve as a bending fork. The shaping of each piece is accomplished by a series of slight bends following close upon each other as



Patterns on squares for easy enlargement; the lap joint and scroll ends; the method of drilling the eye tip; and the scroll former



How the forming tool is used to start the bending of a scroll after the end of the stock has been filed to shape



Although it is comparatively easy to make, this fixture is highly decorative because of the hammered texture and hand-bent curves

the stock is advanced little by little through the bending tool.

If a forge is available, weld the lap of the 12-in. circle; otherwise prepare a lap as shown. The ring at the top is a $\frac{3}{8}$ -in. cast-iron eye tip (a standard fitting). A $\frac{1}{4}$ -in. hole is drilled diagonally into the eye tip for the electric cord.

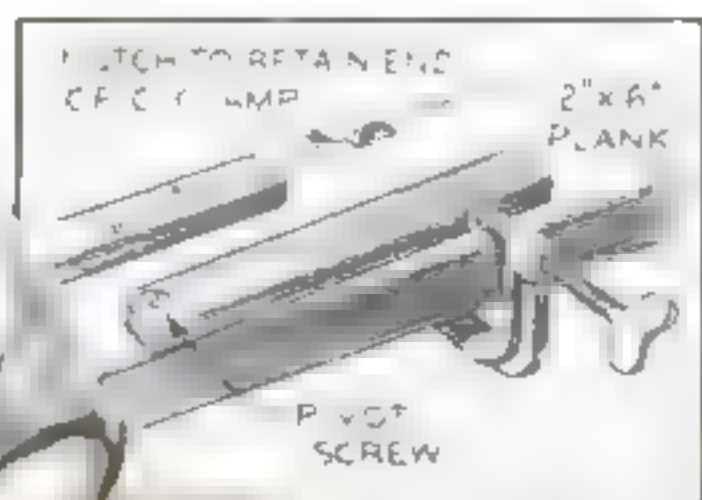
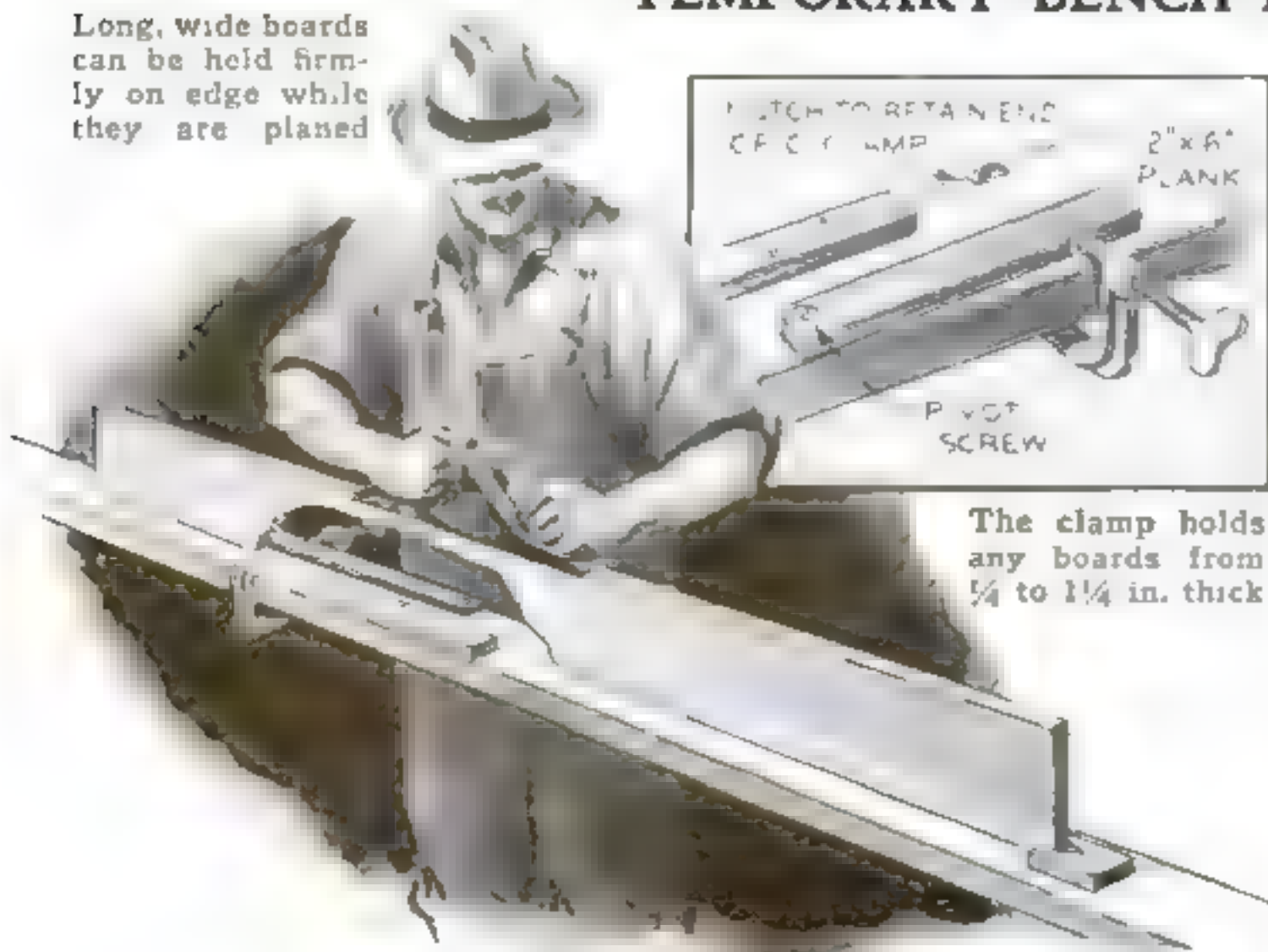
Place a reducing bushing of the type used by plumbers in the eye tip so that it will accommodate a short piece of electrician's $\frac{1}{8}$ -in. threaded pipe. A hexagon lock nut will then fasten the whole assembly. At the bottom fasten the three parts with a $\frac{3}{16}$ -in. roundhead stove bolt or a rivet.

The candle fixtures are attached with threaded pipe and hexagon nuts. Use black lamp cord and hold it in place along the central part of the ornament with small cotter pins or wire hairpins passed through small holes. Give the ironwork a coat of black iron paint.

Use iron or brass electrician's fixture chain. A suitable ceiling attachment may be purchased with the chain, and both should be painted black so that they will match the wrought iron.—GEORGE A. SMITH.

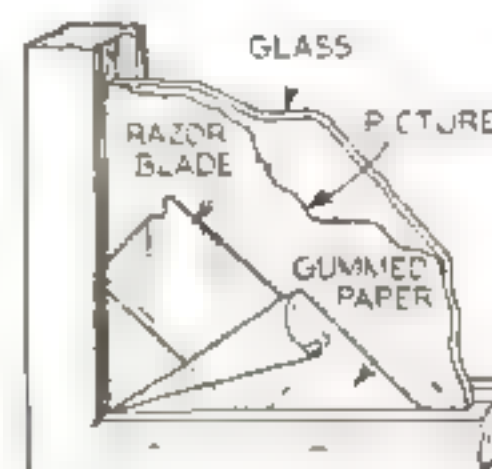
TEMPORARY BENCH FOR PLANING

Long, wide boards can be held firmly on edge while they are planed



The clamp holds any boards from $\frac{1}{4}$ to $1\frac{1}{4}$ in. thick

When the edges of wide boards have to be planed and no bench is available, a substantial work holder may be made as shown from a 2 by 6-in. plank. It can be set up across the corner of a room, running from one window sill to another, or otherwise supported. If a large, wide sawhorse is available, its top can be used instead of a plank. Any large clamp will do.—W. C. HARWOOD.



FASTENING PICTURES IN FRAMES

If driven firmly into the corners of a small picture frame and covered with triangular pieces of gummed paper, old razor blades of the type shown are more effective than the brads ordinarily used to hold pictures in place.—ROBERT M. EADIE.

A FILLER FOR DECAYED WOOD

Decayed spots in trees, posts, and other exposed wood may be filled, after being cleaned out, with a mixture of heavy roof paint or pitch and sawdust.—M. G.

Capt. E. Armitage McCann
tells how to prepare the

SPARS

FOR OUR PICTURESQUE NEW

Brig Model



IN RIGGING our new model* of the brig *Malek Adhel*, the first step is to make the spars. The dimensions may be taken from the rigging plan.

Lowermasts taper very slightly from deck to upper edge of trestletrees. From that point they are square. Where trestletrees and cheeks lie, they are flattened fore-and-aft. At extreme top is a smaller square on which the cap fits.

Topmasts. Almost parallel to their heads, which are squared.

Topgallant masts do not taper, but have shoulders at topgallant and royal mastheads. The poles are tapered.

* The construction of the hull and deck fittings was covered in three previous articles (P.S.M., Mar. '37, p. 77, Apr., p. 92, and May, p. 93).

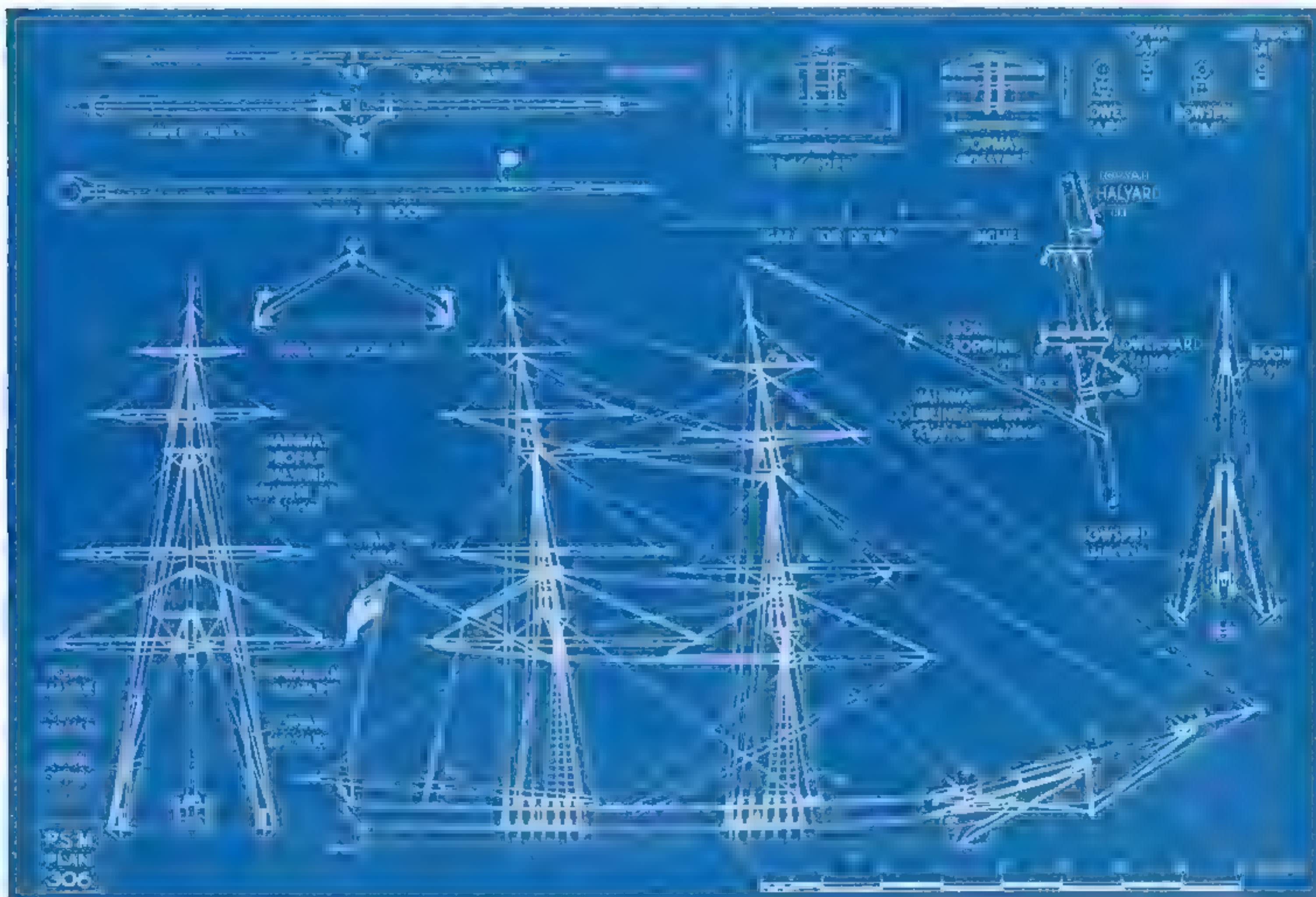
Because it has only two masts, the model is much easier to rig than a clipper ship. The large scale also aids, the model being 33 in. long over all

Yards. Same diameter for nearly one third their length; then taper to yardarms, where there are shoulders.

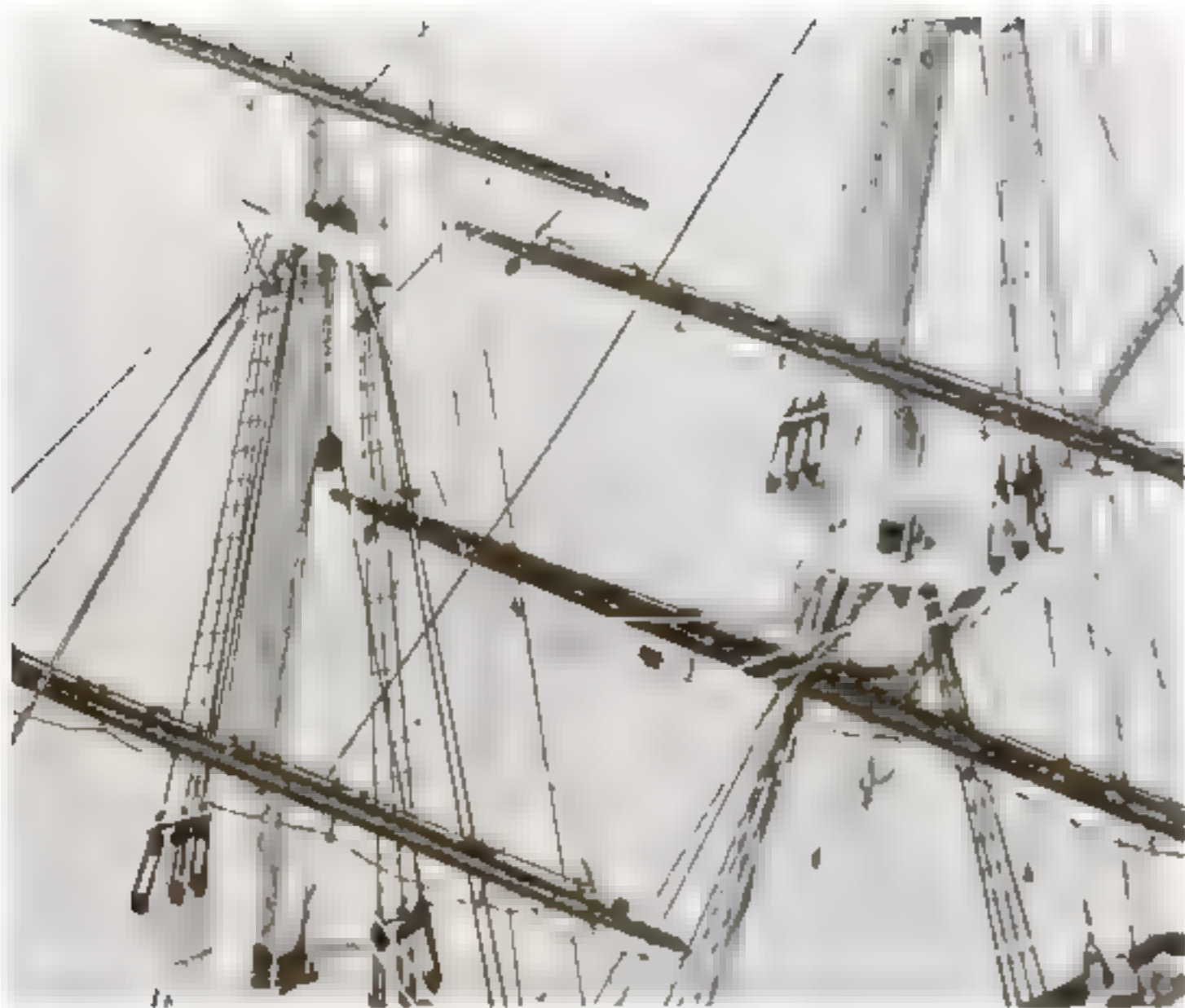
Bowsprit tapers slightly, inside and out, from the stem. End is squared for the cap. Inside end is shaved down to rest at correct angle. *Jib boom* tapers slightly. Has notch at inner end for the lashing. End is squared. *Flying jib boom* tapers slightly and has notch for the lashing.

Both booms have vertical holes where indicated for stays to pass through. The hole in the jib boom near the cap is, however, out of line with the square end of the boom for the reason that the cap must set at a slight angle, thus causing the flying jib boom to lie to one side and clear the stay.

Spanker boom and gaff are thickest one third from the mast.



Rigging plan of the *Malek Adhel*, and details of yards, driver boom, crosstrees, tops, and caps. Dimensions can be found by using the scale



Not a photograph of the real brig—just a detail of the model made by Captain McCann. Try to match this workmanship in your model

Bowsprit fittings. Small cleat just outside knightheads to hold the gammoning. Another for heel of jib boom to rest on and against. On either side at end, bees or cleats with holes in them for the foretopmast stays to pass through. Immediately abaft these, 3/16-in. deadeyes for bowsprit shrouds. Another deadeye at end, underneath, for the bobstay.

Lowermast fittings. Flat pieces (cheeks) glued and nailed on to support trestletrees. Below them, the truss bands and futtock shroud bands. Near deck at the foremast only, a pin band. Several turns of a strip of paper will represent these bands, or brass may be used. On either side of futtock bands are strong eyes made of wire or very small screw eyes. To hold the five belaying pins, make a small eye

in five 1/2-in. pins and set a belaying pin in each. Drive the points into the mast through the pin band. In either side of the fore truss band, abaft, set eyes for main braces.

Mainmast fittings. A heavy band (of wood) about 3/32 in. square in section to support jaws of driver boom. The hole in this must be such as to let the band itself lie horizontally. Fifteen mast hoops may be added, if desired, for the leech of the driver.

Topmast fittings. Holes near heel, athwart, for the fids, which are pieces

of wire which pass through the masts and have their ends resting on the trestletrees. Fore-and-aft holes 3/16 in. below the crosstrees for topsail halyard ties.

Topgallant-mast fittings. Similar holes for fids and topgallant and royal halyards. Round balls (trucks) on ends; these may be gilded.

Lower-yard fittings. For trusses bend piece of No. 18 soft brass or copper wire to the required U-shape. Flatten the middle vertically, the end lugs horizontally. Solder the ends between the lugs of brass bands that fit tightly on the yard. Drill hole in middle of truss. Drive an escutcheon pin through the hole, through a very small sleeve, and into mast. Place another band on middle of the yard. In this set a stout eye or staple for the

chain sling. The other end of the sling fastens to an eye in the mast between the cheeks. *Jackstays* are No. 24 wire rove through eyes made of small pins. Footropes and their stirrups are thin, cotton-covered wire, dyed black. *Eye bands* are needed at yardarms for lifts and brace blocks. At foremast the eyes are above and abaft; at the main, above and before. They can be of twisted wire.

Topsail-yard fittings. A wooden saddle and parrel. The saddle is nailed to after side of yard and fits half around the mast. To this is nailed (with pin points) a strip of brass, which fits around the after side of the mast. Place a band and a bolt in middle of yard for chain tie, and add eye bands, jackstays, and footropes. Note that these are slightly different from those on the yards below.

Topgallant and royal yards. Similar to topsail yards, but everything slightly smaller.

Driver boom and gaff. Make jaws to fit around mast by boring a 3/8-in. hole in a piece of 3/32-in. thick wood, cutting to shape, and sawing in two. Flatten ends of spar slightly where jaws are glued and nailed on. Drill holes through the horns for retaining cords. Just outside the taffrail level, the boom has a U-shaped traveler for the sheets; the ends of this are forced into a hole athwart the boom. The gaff has an eyebolt at end for signal halyards; another near the shoulder; one at the jaws, above, for throat halyards; one beneath for a downhaul.

Martingale boom, commonly called the "dolphin striker." Diameter at middle is 1/4 in. Use a collar or fine wire binding at each end. At two places near the end, drive a piece of wire through and turn down the ends to form cleats. Put a spike in the top end to drive into bowsprit cap. File small notch close to lower end

Color. The (Continued on page 104)

AMUSING DOG-AND-BONE HOLDER FOR NECKTIES AND BELTS

AS USEFUL as it is amusing, this necktie and belt holder is designed in the form of a dog's head with a bone. One end of the bone will hold a large number of ties; the other end, several belts.

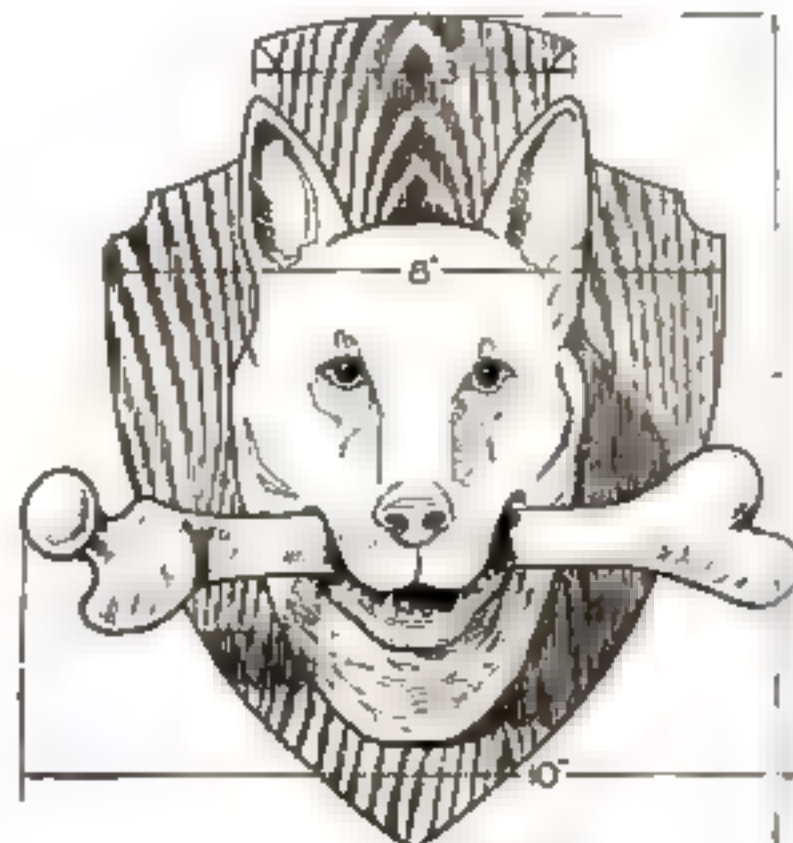
Draw a profile of the head on stiff paper and transfer it to a block of wood 5 in. thick, 7 in. wide, and 8 in. long. Band-saw the head, trim the corners with a saw or rasp, bore a hole for the bone, and carve the teeth, lips, nostrils, and ears. This work may be done with hand tools, but a carving bit in a flexible shaft, if available, will do it in considerably less time. For eyes, cement white marbles into tight-fitting holes. Do the final finishing on a sander or a sanding roll in the lathe, if the necessary equipment is at hand.

The bone is made from a piece 1 1/2 in. thick, 2 in. wide, and 10 in. long. Turn or whittle the center portion round, swelling gradually into the ends. Then band-saw the knobs, round them with a file, and sand. Cut the bone in two and glue it into the dog's mouth.

The shield is made as shown, with the edge molded if desired. Paint the dog black, tint the lips, gums, and eyes a natural color, and use ivory enamel for the teeth and bone. Varnish the shield and rub with pumice stone.—D. C. MARSHALL.



A flexible shaft with a carving bit will save a little time, if available



Craftsmen who like to make projects that are out of the ordinary will find this combination tie and belt holder a design worth following. The dog's head is comparatively easy to carve

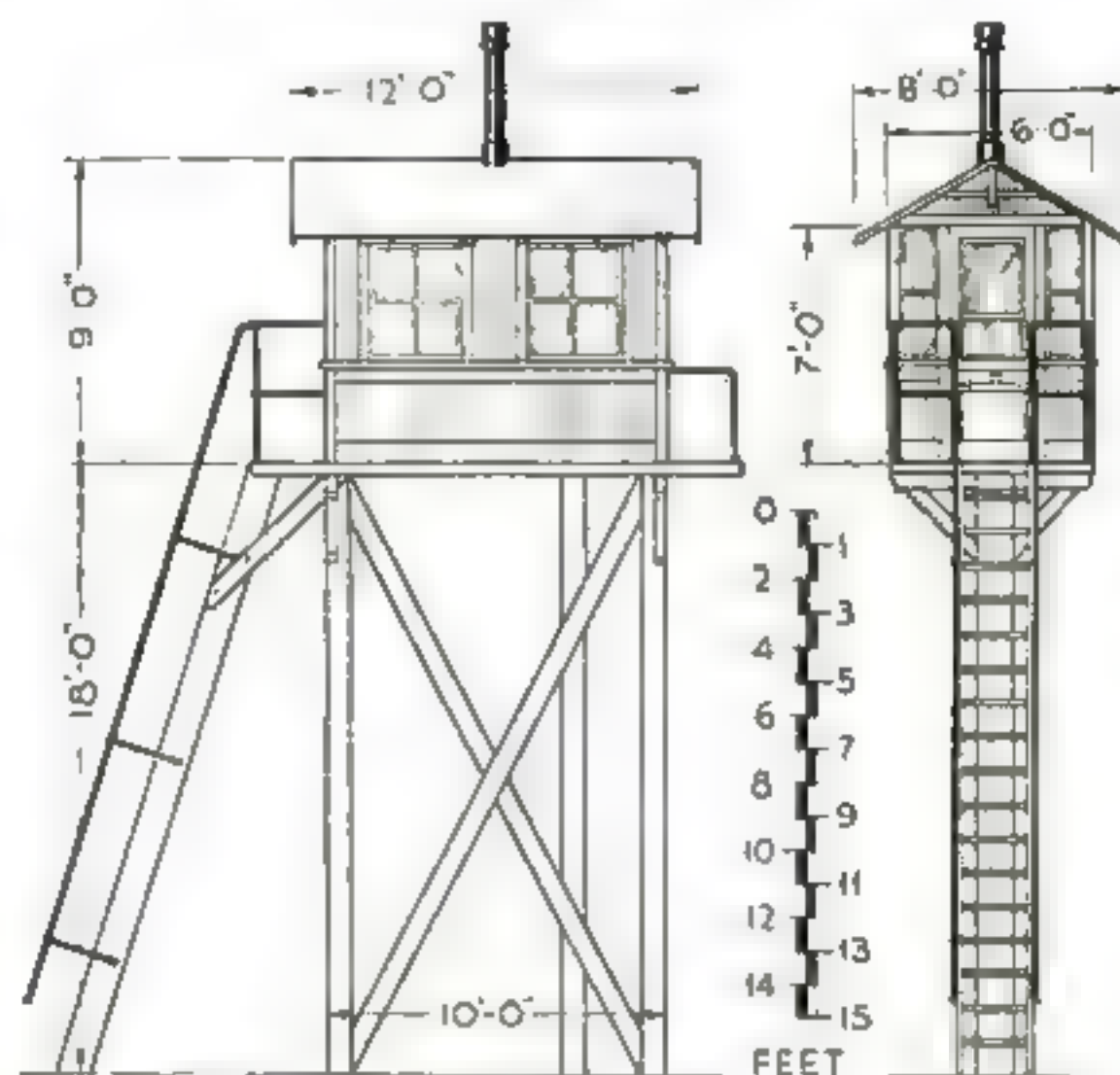


HINTS FOR BEGINNERS IN Model Railroading

How to Build a Crossing-Gate Tower

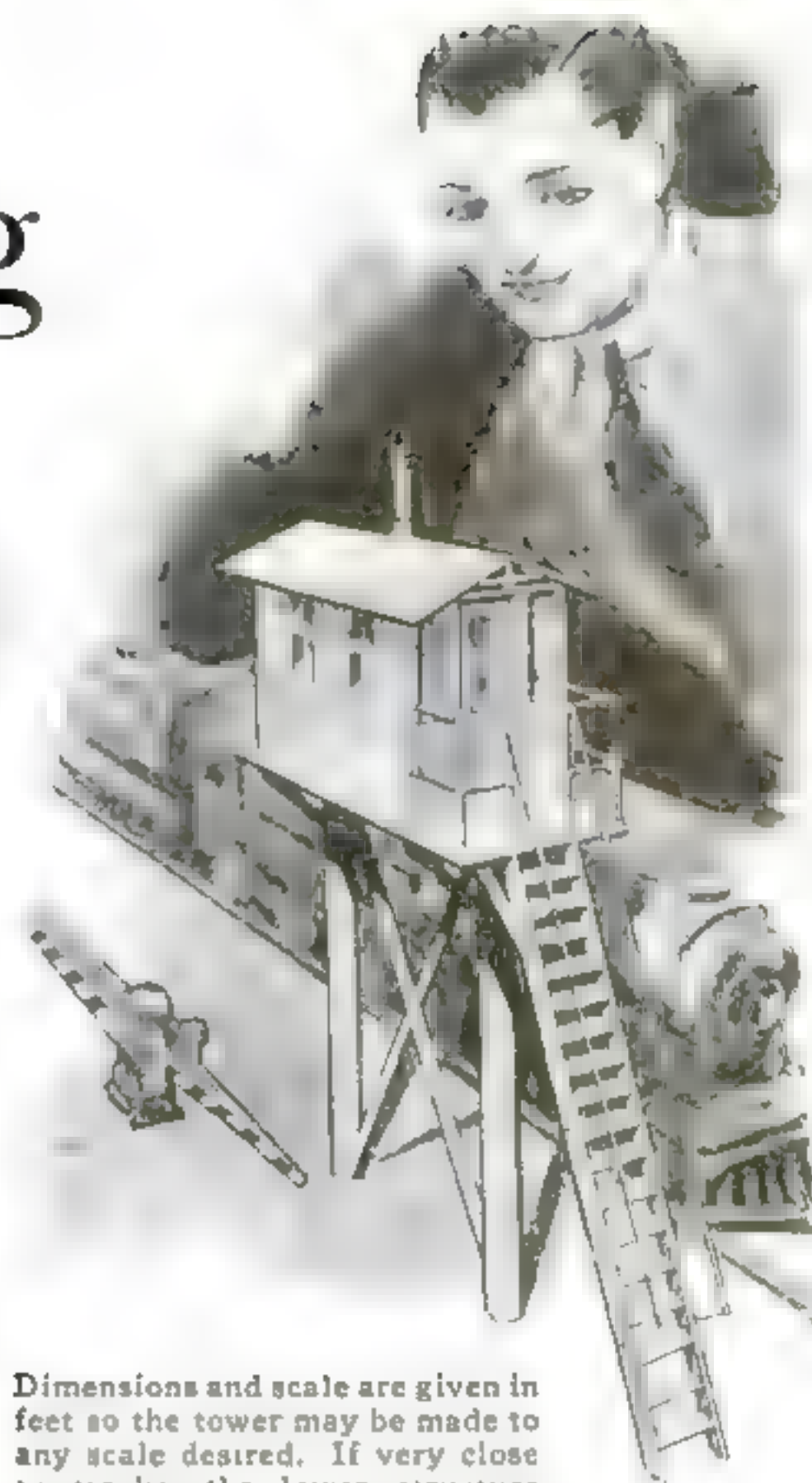
IN THE warehouse district of your main terminal, a model crossing-gate tower will add a realistic touch. The drawings give full-size dimensions so that you can build the model to whatever scale you have adopted for your system. If the tracks are laid on 14-ft. or more scale centers, the structure may be placed between them.

Specifications: House, Bristol board, scribed to represent grooved siding. Sashes and doors, thin card cut out and glued behind openings; and celluloid glued back of this to represent glass. Roof, thin wood or Bristol board with thin strips of wood glued underneath to represent rafters. Chimney, whittled from wooden dowel. Railings, soldered from wire. Colors, dark brown underframing, buff building with brown trim, black chimney and railings, tar-paper roof. The opposite end of the building is like



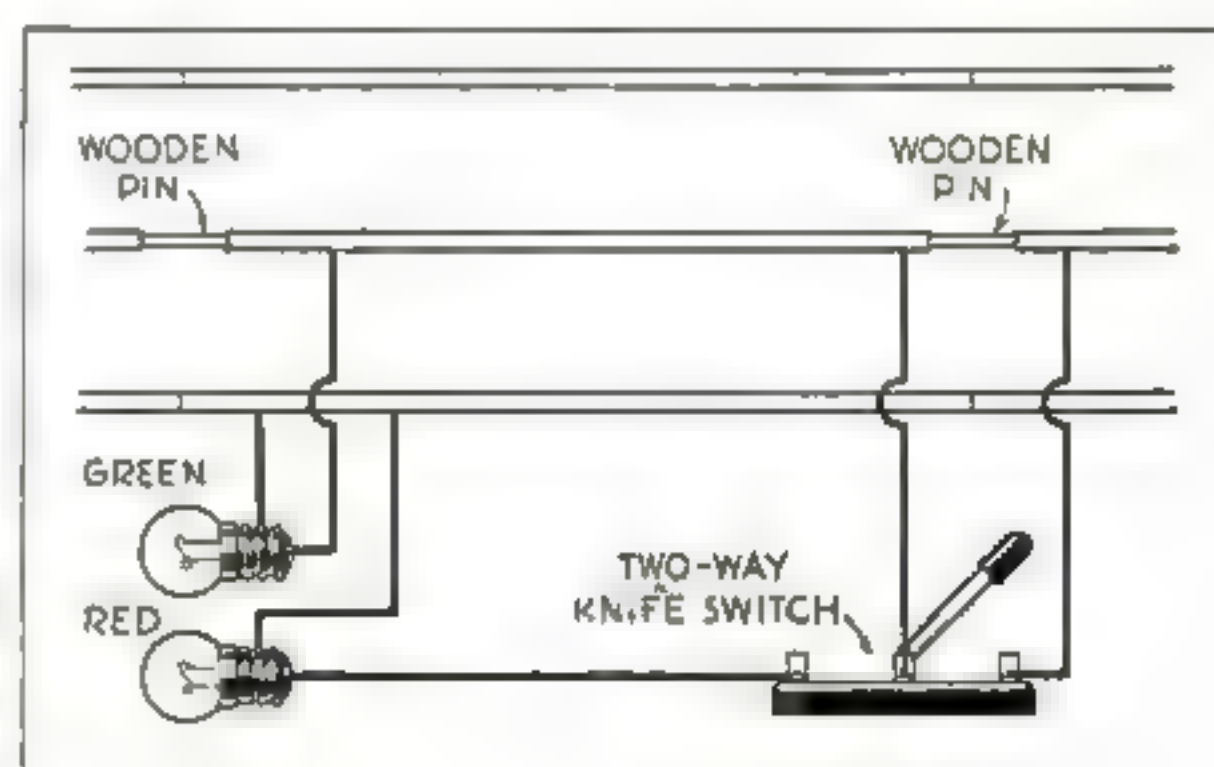
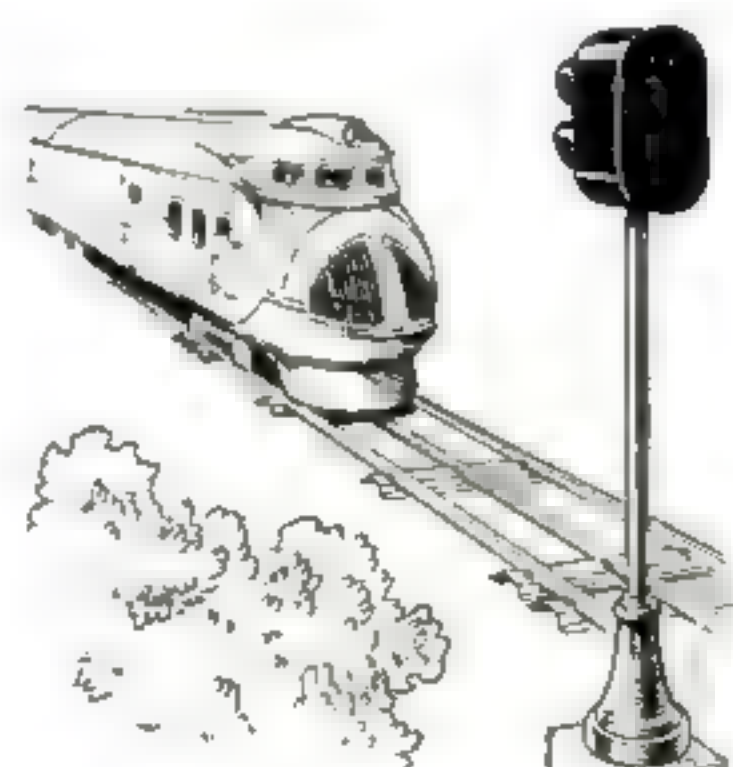
the one shown except there is no ladder. A crossing gate is, of course, an essential complement.—HAROLD A. SCHUPP.

Dimensions and scale are given in feet so the tower may be made to any scale desired. If very close to tracks, the lower structure should carry a sign that it "will not clear a man on side of car"



Tape on Track Prevents Derailment at Curves

IF YOUR model railway train has a tendency to hit the curves at such speed as to cause derailments, a simple remedy is to tape a portion of the third rail in the last section of straight track preceding the curve. Ordinary 1/2-in. wide surgical tape gives excellent results, and the proper length can be found by experimenting. Of course, if you are using automatically reversing locomotives, the reverser must be locked in the forward run position, or the engine may reverse.—JACK ABERT.



Assembling Cars from Odds and Ends

IF YOU have only passenger coaches and Pullmans on your model railway, you will find new interest in devising other types of cars from inexpensive materials.

For example, the oil tank car shown under construction at left is being made from a piece of pressed composition wood for the base, a couple of empty beer cans, an odd screw cap for the dome, and a few bolts, screw eyes, split rivets,

and pieces of wire. The lumber car has a similar pressed composition wood platform and eight corner braces for the stakes. The braces are fastened on with split copper rivets. Careful painting makes such cars surprisingly realistic, and a little ingenuity will work wonders.

As the trucks of most factory-built model railway cars are easily detached, you can borrow trucks from passenger or other freight cars that are temporarily out of use.—ROBERT W. BRIGGS.



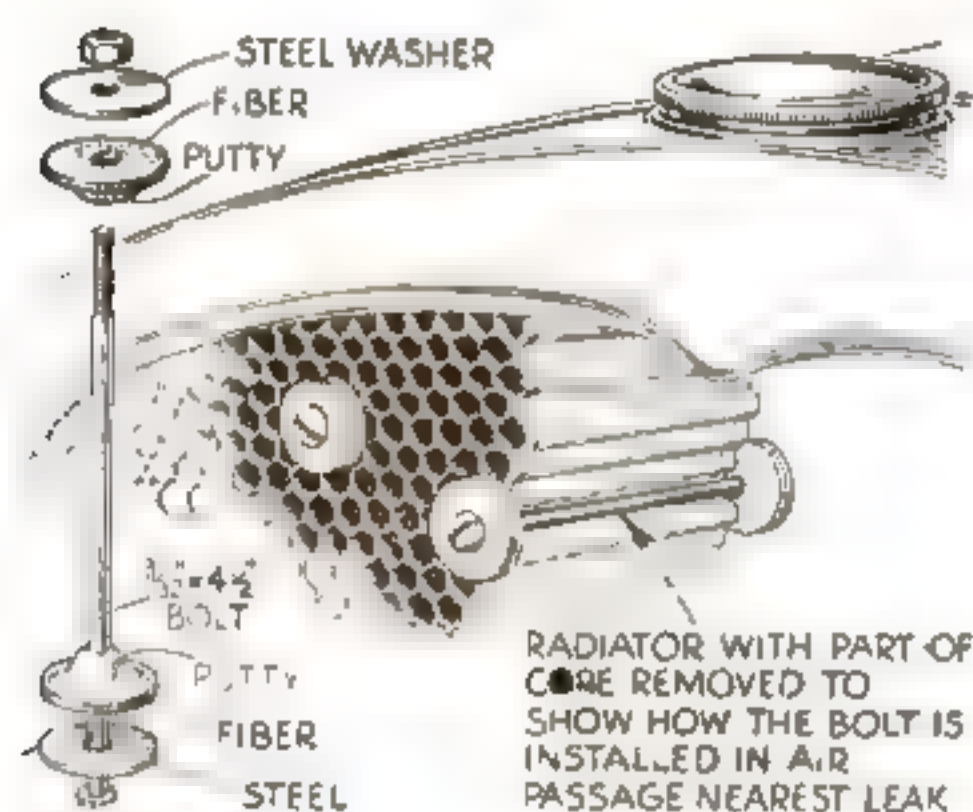
Oil tank car made mainly from two beer cans, and a lumber car with ordinary corner braces for the stakes

Timely Hints FOR CAR OWNERS

Double Mirrors Make Passing Safer

PASSING large trucks on a narrow, busy road is always dangerous because it is impossible to see approaching traffic without driving one's own car partly on the wrong side of the road. The danger can be eliminated, however, by the double-mirror arrangement shown in the drawings. One mirror is of the usual type, mounted on the front-door hinge or windshield frame, facing backward. A second mirror, facing forward, is attached to the central pillar of the body, behind the front door. It should project as far as the outside edge of the running board. Once the mirrors have been adjusted, which will call for a little experimenting, they should be clamped firmly.—J. W. W.

This arrangement of two mirrors enables you to see far ahead without pulling over on the wrong side of the road



Leaky Radiator Fixed With Bolt and Washers

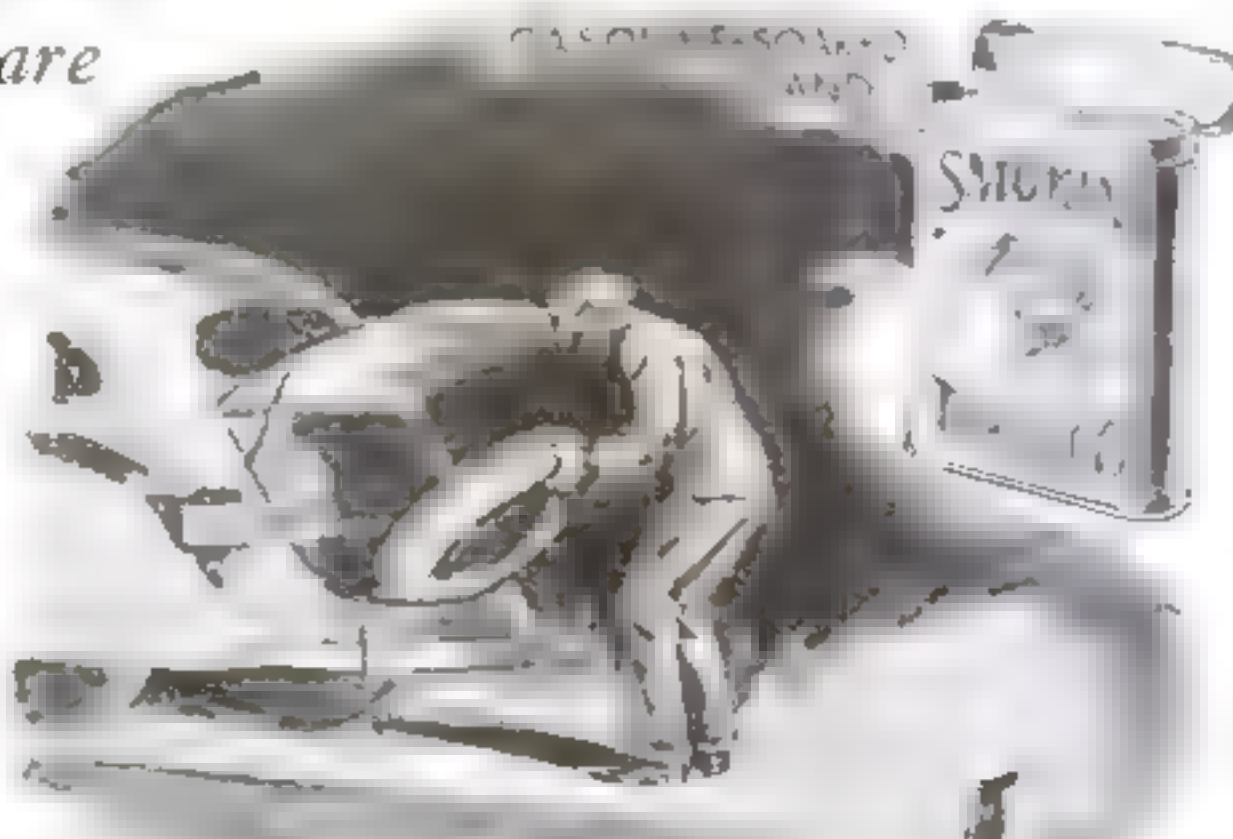
WHEN the honeycomb-type radiator of my car developed a leak in the soldered edge seams, I repaired it with a long, narrow bolt, such as is used in installing radiator shields, a nut, two fiber washers, and two steel washers, along with a little putty; arranging these parts as shown in the drawing. Tightening the nut forces the putty into the fractures making a repair that will last a long time.—C. P.

Finding Sticking Valve

A MISS in a car's engine caused by a sticking exhaust valve can be detected by listening to the exhaust while the engine idles. A hissing or blowing noise means that a valve is failing to close.—C. F.

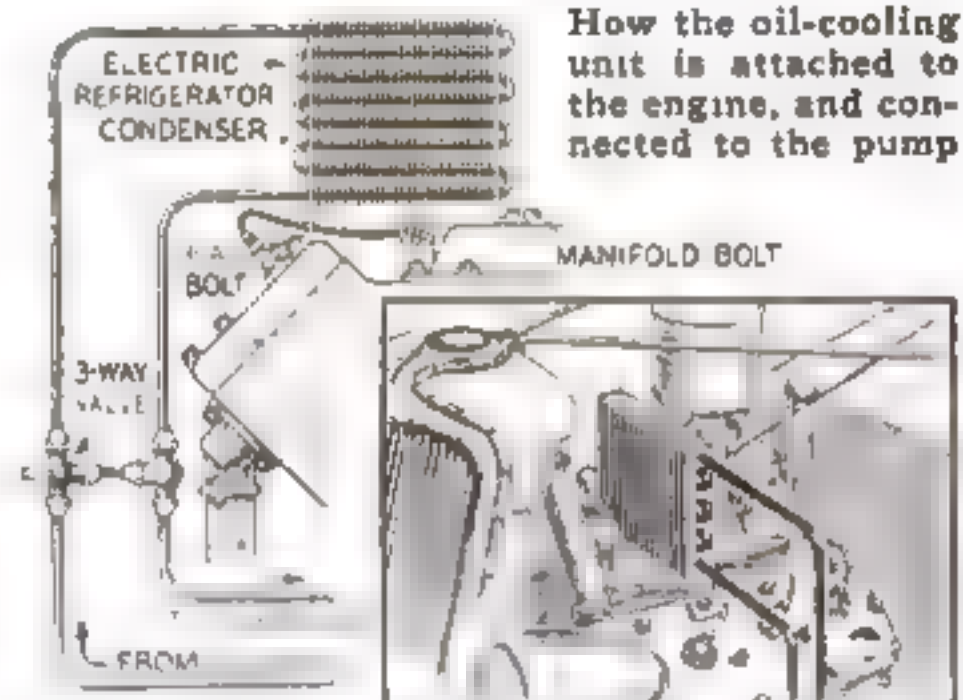
Tobacco Can Makes Good Emergency Road Flare

AN IMPROVED road flare like the one shown in the drawing may prevent a serious accident if a flat tire or engine trouble forces you to stop your car on a dark road. Simply take a tobacco can, or similar container, fill it with sand or loose earth, and pour in a little gasoline. Set the can several yards behind the car; once lighted, it will burn for half an hour or more, giving adequate protection from approaching cars.—W. A.



Oil Cooler Is Made from Old Refrigerator

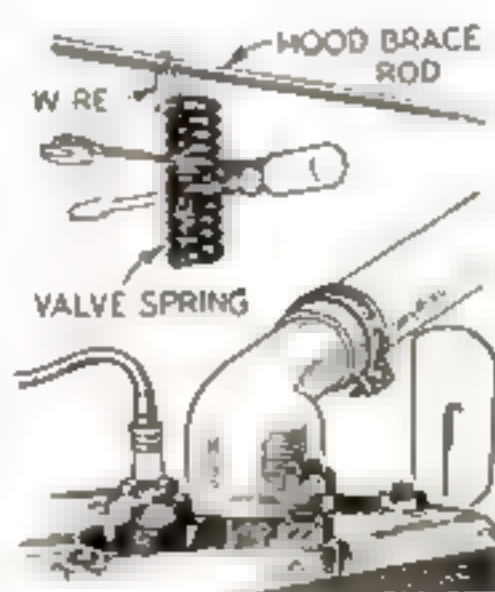
THINNING out of motor oil in the hot summer months can be prevented by equipping your car with this home-made oil cooler. It consists merely of the condenser unit from an old electric refrigerator attached to one of the car's cylinder-head nuts in such a position that it gets the most benefit from the fan's air blast. The oil passes through it from the oil-pump outlet to the bearings. The three-way valve shown in the drawing serves as a by-pass to cut off the cooling unit in winter.—R. J. H.



How the oil-cooling unit is attached to the engine, and connected to the pump

Coil Spring Supports Small Tools

SMALL tools are easily misplaced when working on an automobile engine, and much time is wasted in looking for them. To provide a handy rack for pliers, wrenches, and screw drivers, get an old valve spring, and hang it from the radiator tie rod with heavy wire. Tools are held firmly between the coils.—A. H. W.

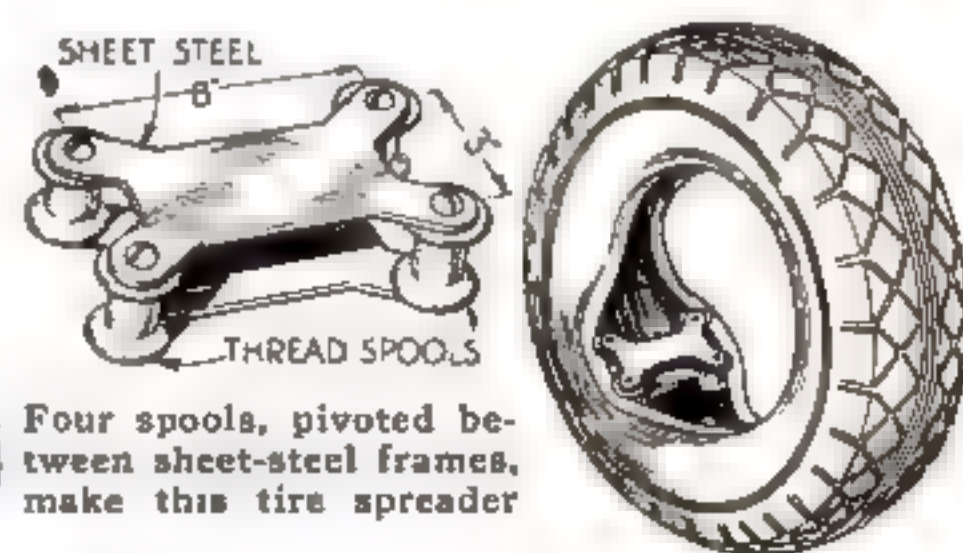


A coil spring makes a handy small-tool rack

Cleaning White Tires

THE PROBLEM of cleaning white-wall tires can be solved easily by using a brush and one of the paste-type hand soaps. When the tires have been well scrubbed, the soap and dirt can be wiped off with a wet cloth. This is especially effective in removing curb marks.—L. V. H.

Homemade Tire Spreader Makes Inspection Easy



Four spools, pivoted between sheet-steel frames, make this tire spreader

WHEN you are trying to locate the nail or break in the fabric that caused a flat tire, one of the first things to do is to inspect the inside of the casing. This little spreader makes it an easy task. Cut two pieces of sheet steel to the shape illustrated, and at each corner mount a wooden thread spool, bolted or riveted so it can turn freely. The spreader is put between the beads as shown. It slides along freely, making it easy to check every inch of the tire.—H. A.

**11,000
VOLTS**

**What a power-line
"trouble-shooter"
is up against**

AL Taft works in a maze of high-voltage wires. Around him—11,000 volts lurk. A tense job that will test digestion if anything will! Here's Al's comment: "Sure! Working among high-voltage cables isn't calculated to help one's digestion. But mine doesn't give me trouble. I smoke Camels with my meals and after. Camels set me right!"

Make Camels a part of your dining. Smoking Camels speeds up the flow of digestive fluids—*alkaline* fluids. Being mild, Camels are gentle to your throat—better for steady smoking.

**HEAR
JACK OAKIE'S
COLLEGE**

A gala show with "President" Jack Oakie in person. Fun and music by Hollywood comedians and singing stars! Tuesdays—8:30 pm E.S.T. (9:30 pm E.D.S.T.), 7:30 pm C.S.T., 6:30 pm M.S.T., 5:30 pm P.S.T., over WABC-Columbia Network.

WELCOMES A "LIFT." "I have my hands full," remarks Mrs. Richard Hemingway, housewife. "When I feel tired, I smoke a Camel and get the grandest 'lift' in energy."

PRIZES HEALTHY NERVES. Fred Jacoby, Jr., National Outboard Champion, says: "I smoke Camels regularly. They're mild—and never get on my nerves."

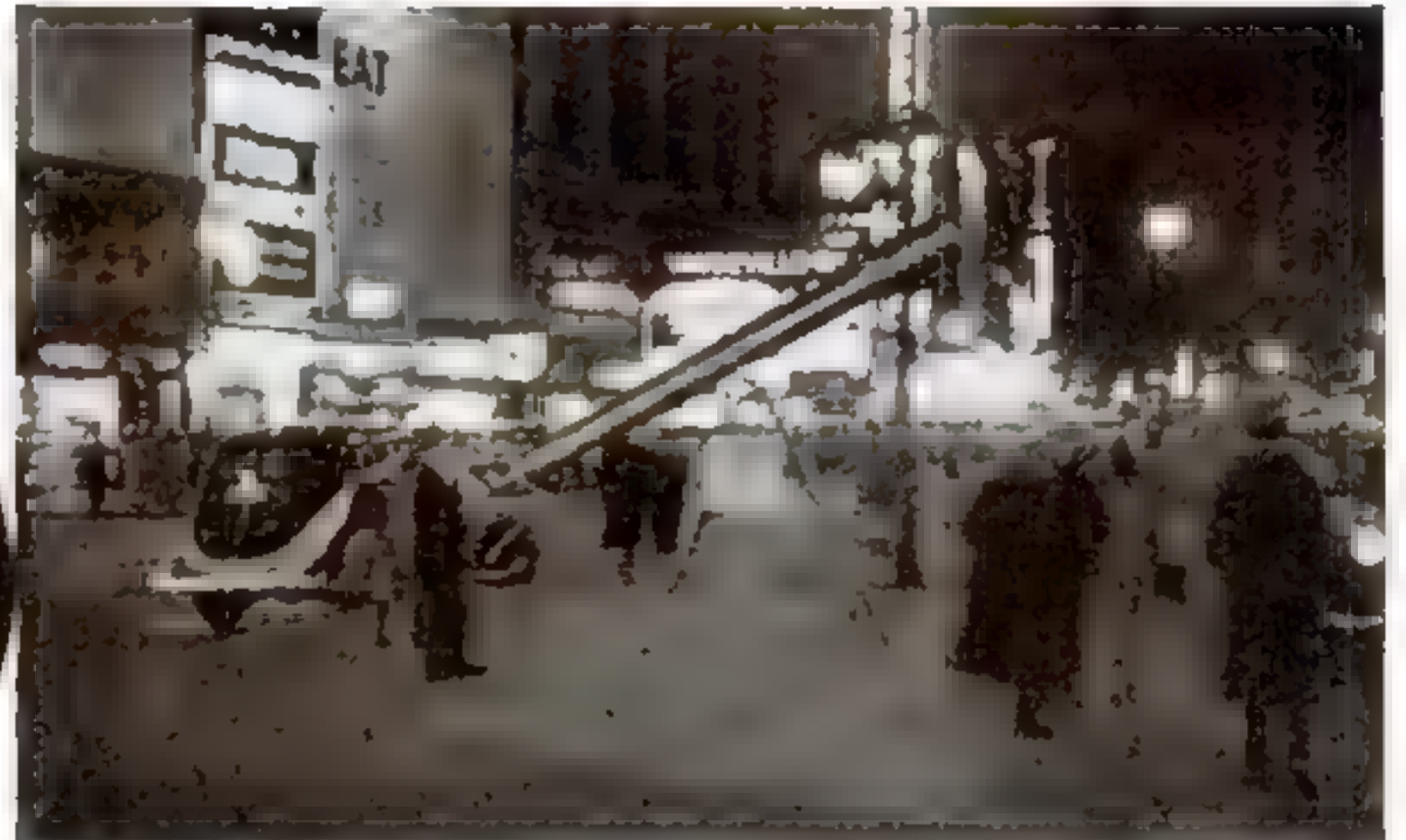


**FOR
DIGESTION'S
SAKE...
SMOKE
CAMELS**

Copyright, 1937 R. J. REYNOLDS TOBACCO COMPANY, Winston-Salem, N. C.

COSTLIER TOBACCOS—Camels are made from finer, MORE EXPENSIVE TOBACCOS—*Turkish and Domestic*—than any other popular brand.

HOW TO GET Striking Shots WITH A MINIATURE CAMERA



Theater-goers, automobiles, and a "five-cents-a-look" telescope skillfully snapped with a miniature camera against the bright lights of a city street

By Frederick D. Ryder, Jr.

WHAT most photographic beginners do not realize is that the amazing results obtainable with a miniature camera are not due to some magical quality in the tiny instrument or in the film it uses. Like the knife in the skilled surgeon's hand, the camera is only a tool that will reflect the skill of the photographer.

The beginner, viewing an exceptionally fine collection of enlargements from miniature camera negatives in an exhibition or in a dealer's window, usually fails to realize how much work went into the preparation of these pictures. Rare, indeed, is it that even one of the group was the result of a single camera exposure and a single enlargement. In nearly every case, the photographer made a large number of exposures of which the one shown is the best, and almost invariably the exhibition print is the culmination of a series of painstaking attempts on different grades of paper.

To take a concrete example, suppose you wish to make a night picture showing the crowds swirling about the brilliantly lighted entrance to a movie theater. If you are the average beginner tackling such a shot, you will swing up the camera and take a snapshot, or perhaps two quick ones at different shutter speeds, then pop the camera back in its case, and duck into the movie palace to see the show yourself! Assuming that your camera had a really fast lens, F/2 or better, was loaded with the fastest panchromatic film, and the exposure was in the neighborhood of a twenty-fifth of a second, you'd get a

picture on the film, but unless you were exceptionally lucky it wouldn't be anything to write home about.

How would an expert, amateur or professional, go about the job? In the first place, he would study the view from all possible angles and take a picture from every one that offered any possibilities. He would also study the crowd formation in its constant changes and try to time his shots when the people were grouped most interestingly. And if he were particularly foxy, he might even tip the man who takes care of changing the electric sign to slip a couple of photoflood bulbs into sockets up under the marquee where they would brighten things a bit without shining directly into the lens.

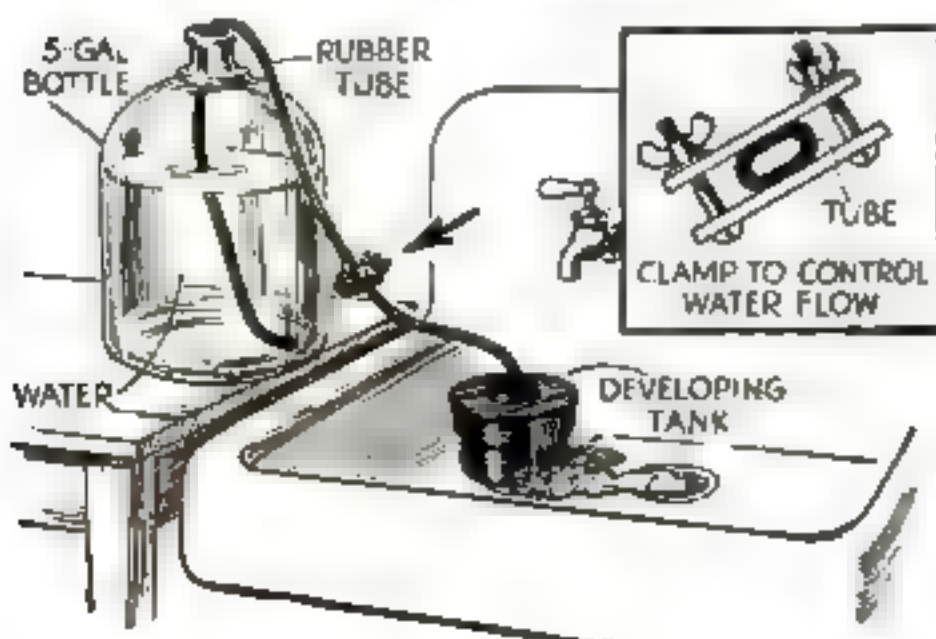
Generally speaking, success in getting a fine picture under any difficult set of conditions rests on the same procedure, that is, a careful study of the possibilities coupled with a determination to use as much film as necessary to take every shot that offers any hope of good results. The large magazine capacity of most miniature cameras is one of the reasons why such cameras are so useful for this work.

Another trouble that often discourages the beginner is the number of fuzzy pictures he will get. There are two causes. First, the purchaser of a miniature camera frequently gets the idea that because of the short focus of the lens, accurate focusing is unnecessary. While it is true that a short-focus lens has greater depth than a longer one, other conditions being equal, this advantage is offset to a considerable extent by the *(Continued on page 100)*

Rings like these sometimes cause baffling difficulties in enlarging miniature negatives



Rubbing the back of a negative with talcum powder prevents the formation of the rings

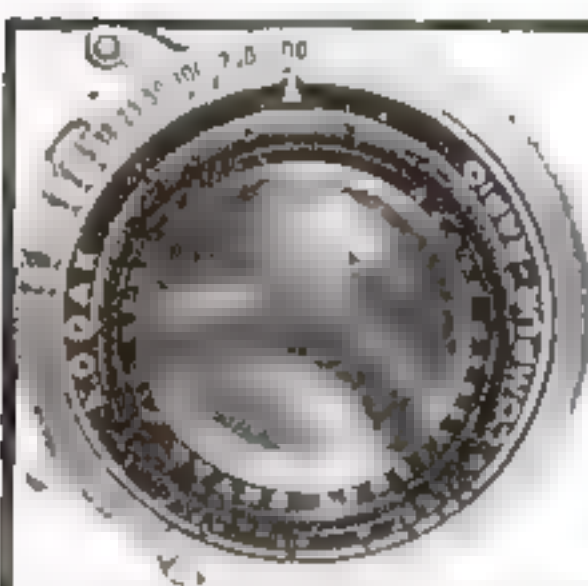


A bottle supplies wash water at same temperature as the developing and fixing solutions



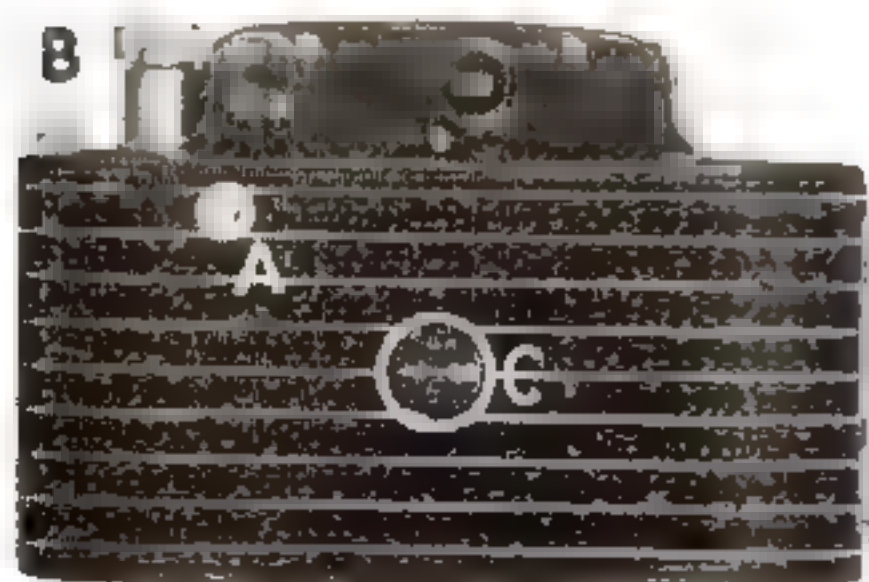
Picture Story of Eastman's Finest Miniature **KODAK BANTAM SPECIAL**

LENS . . . Super-speed, super-corrected Kodak Anastigmat EKTAR *f*.2.0. Shoot early or late, in sun or rain; go after lightning-swift action; snap away indoors at night—your negatives will be needle-sharp; they'll yield big, detailed enlargements. (Standard, low-cost enlarged print size is $2\frac{3}{4} \times 4$ inches.)



COMPUR-RAPID SHUTTER

With nine speeds from 1 to $\frac{1}{500}$ second, it capitalizes to the full the Kodak Bantam Special's ability to cope with swift action, or difficult light conditions.



CONVENIENT LOADING

Pull-out lock opens the hinged back. As the illustration shows, the winding knob can be extended beyond the housing of the camera for easier winding of the film. Specially designed film pressure plate assures precise film register.

AUTOMATIC FILM CENTERING DEVICE

You merely press the button "A" while turning the winding knob "B" about a half turn, then release the button and continue winding until the knob locks. The film is then in position for the next exposure. The only time you uncover the film window "C" is when you wish to check the number of exposures you have made.



RANGE FINDER . . . Split-field, military-type, coupled with the focusing mechanism, and adjustable to the individual user's vision. The range is found by moving the focusing knob. When the split image is brought into a straight line, the camera is in focus—in one operation—nothing else to do.



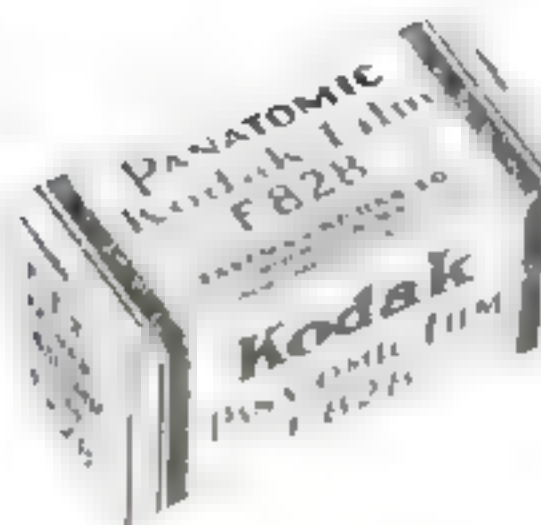
As image appears when range finder is set for a distance shorter than the correct one.



As image appears when range finder is set for a distance greater than the correct one.

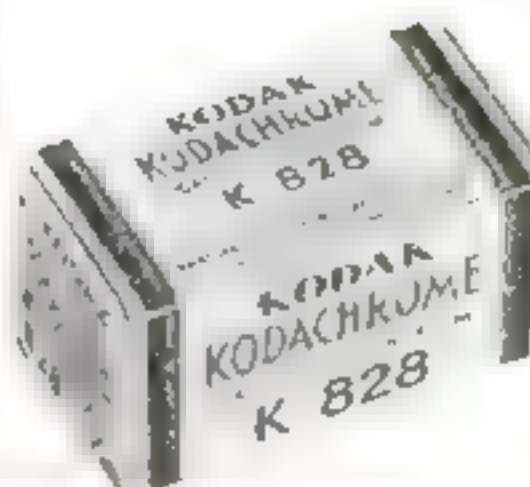


As image appears when the range finder and focus have been simultaneously adjusted.



● For superb enlargements, for wonderfully rich contact prints in any size, load with Kodak Panatomicron Film. Completely color-sensitive, and the fine grain permits an astonishing degree of enlargement.

● For snapshots very early or late in the day, fast action shots, and indoor pictures with Kodak Bantam Special, use Super X Film. Extra-fast, color-sensitive, fine-grained.



● Loaded with Kodachrome Film, Kodak Bantam Special gives you gorgeous full-color transparencies to be viewed as they are or mounted in slides for large-size home projection with the Kodaslide Projector.

KODAK BANTAM SPECIAL, '110 AT YOUR DEALER'S

Eastman Kodak Company, Rochester, N.Y.



WHY

Clipshave's Simplified Two-Way Shearing Head **GIVES SMOOTH shaves**
CLOSE shaves
QUICK shaves

IT shaves in plain sight at the leading edge. You always see exactly what you are doing and therefore hard-to-reach places do not exist for Clipshave. It trims sideburns easily and accurately.

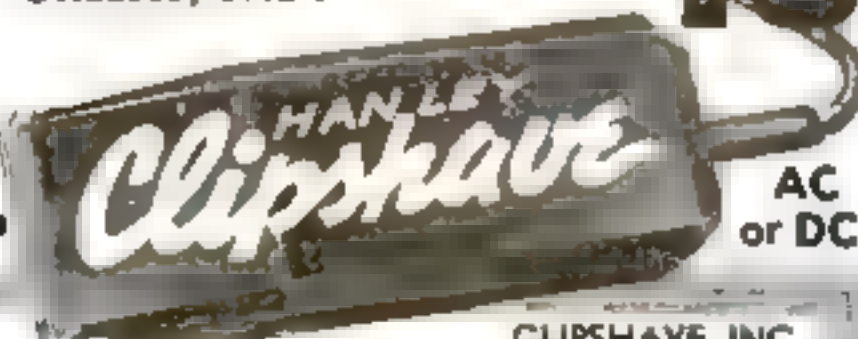
The V-shaped openings are so designed that all types of hair—long or short, fine or coarse—enter freely and are shaved skin-close with amazing comfort. Clipshave's unique, triple-impulse motor is a marvel of swift, silent vibrationless power.

Because all hairs are ejected from the shearing system and not into it, Clipshave is absolutely clog-proof, and needs no special cleaning. Clipshave's very simplicity, with the fewest possible moving parts, makes it the most efficient electric shaver you can buy, and lowers its cost to you. Operates economically . . . plugs into any AC or DC outlet.

BUY A CLIPSHAVE TODAY—

If your dealer can't supply you, send \$10 to Dept. U, Clipshave, Inc., Port Chester, N.Y.

\$10



CLIPSHAVE, INC.
DEPT. U, PORT CHESTER, N. Y.

Please send me a Clipshave in payment for which \$10 is enclosed. It is understood that should I return it in good condition within 30 days, my money will be refunded.

NAME _____
STREET _____
CITY _____ STATE _____

New Tubular Wall Lights

Will Improve Your Bathroom

By
HAROLD P. STRAND

INSTALLING a pair of the new tubular wall lights on each side of the mirror will give a modern touch to any bathroom and provide excellent illumination for shaving. The luminous tube is rated at 40 watts and can be had in several color shades besides white, but the latter is best for maximum light. The chromium-plated fixtures can also be obtained in a variety of shapes and designs and are made to take one, two, or three tubes.

If wall fixtures of an older style are in place, with ordinary round outlet boxes, it is usually possible to substitute switch boxes, and the tubular fixtures may then be installed. In the case illustrated, however, no wall lights were in use, and it was necessary to run BX cable up from the cellar.

Two openings were cut in the plastered wall to fit switch boxes—at the vertical center of the mirror and about 2 in. from each side. At the left opening, a stud happened to be just where the box had to be placed. To insert a flush-type switch box on a stud in such a case, first remove the plaster and cut off the laths with a sharp chisel. Then use a sharp wood bit and brace to drill a series of holes closely around the edge, but take extreme care to avoid catching the bit on the cut-off ends of the laths and breaking the plaster. Drill about 3 in. deep unless you intend to use a shallow switch box, in which case make the holes about 2½ in. With a chisel, cut away the wood between the holes and square up the opening to fit the box.

A hole is next bored in the side of the recess at a position that will line up with one of the side knockouts in the switch box. A "snake" wire is passed into the hole and pushed down to the cellar, where it may be necessary to bore a hole upwards and fish it out. In

Since a stud happened to come where the switch box was to be placed, the wood had to be bored and chiseled out, and the BX cable brought in from the side

These fine-looking lamps are controlled by a switch in the bottom of the fixture



Switch box and fixture bar in position and the back of the fixture itself, showing the connections

the job illustrated there happened to be some pipes at this point, and the "snake" followed them out to the cellar.

An assistant connects a trimmed end of BX cable to the snake wire in the cellar, and the cable is pulled up to the outlet. This is also done for the other outlet. Do not forget to push in the red fiber bushings supplied with the cable to protect the wires against sharp edges. Great care should be taken not to go too deep when cutting BX cable with the hack saw. Usually it is sufficient to cut with a sharp, fine-tooth blade almost through two of the armor strips, the saw being held at an angle to allow the blade to cross and cut two strips at the same time. The piece can



then be given a quick bend at the cut and it will break off cleanly.

The BX cable is brought into each box and clamped under the box clamps provided. One-inch No. 4 flathead wood screws secure the box to the laths. Any broken plastering around the box should be repaired. A switch-box bar supplied with the fixture is attached to the box with 6-32 machine screws. The screw in the center of the bar is removed and is used to clamp the fixture to the wall. Three soldered and taped joints are necessary, as shown, or solderless connectors may be used.

Note the switch in the bottom of the fixture for controlling the tubular lamp. If your room happens to be equipped with a wall switch or you care to wire one in, the fixture switch may be dispensed with and the wires connected from the outlet to the tube wires only.

To insert the tube, clip the small black connecting pieces supplied with the fixture to each end of the tube and push the connecting prongs into the sockets at the top and bottom as shown. Single-tube fixtures were used in this case, but if increased light is desired, the two-tube type will provide it.

The BX cable in the cellar must be run to some convenient point where a "straight" connection can be made—a connection to wires that are not switched. Usually the cable may be run either to some light that turns on with a key or a pull chain, if this exists, or to the meter board. It is not necessary to run both cables from the two outlets to a distant point. A 3-in. junction box is used in the cellar under the outlets, and from this box a single cable is run to the source of supply.

The cable cannot be attached to the main cellar light box because this light is usually controlled from the first floor and would have to be left on in order to use the bath lights.

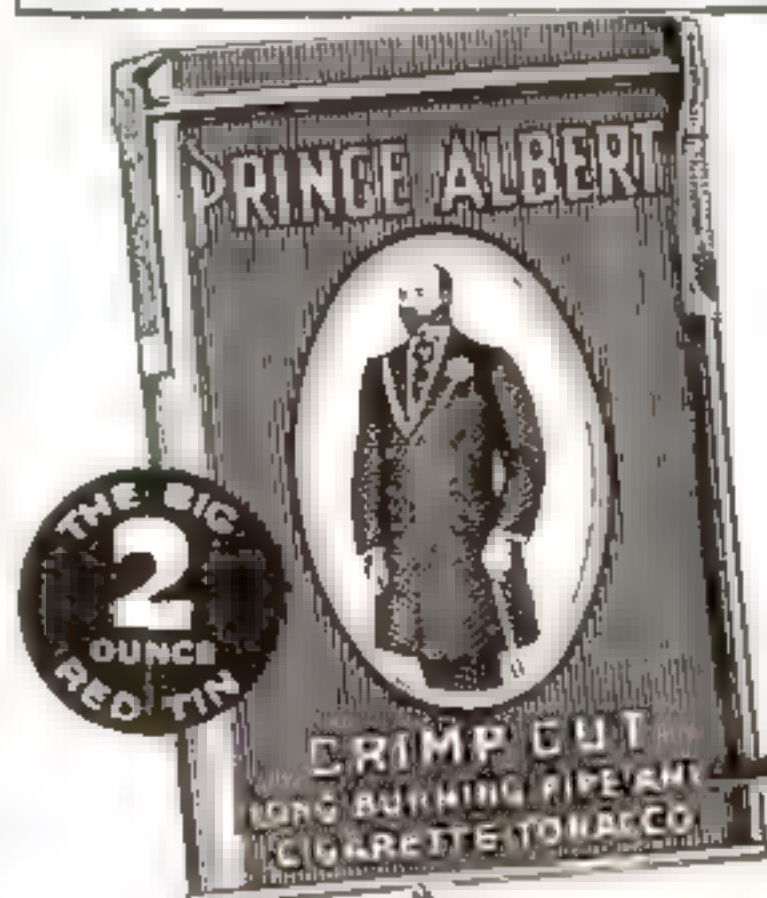
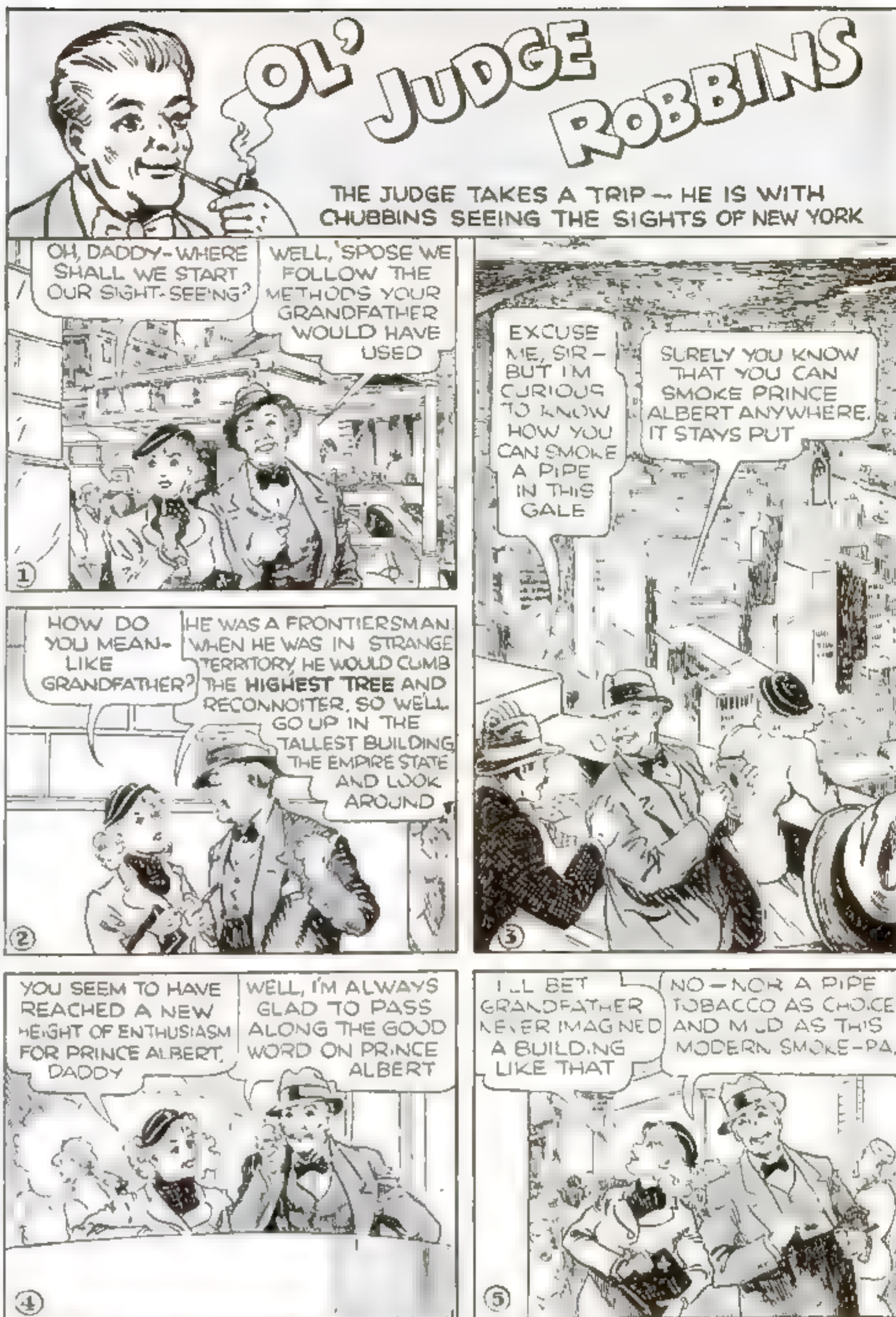
Methods of cellar wiring will have to be left for another article. Some municipal authorities insist that all cellar wiring be done in rigid conduit. To meet this requirement, a new type of threadless tubing may be used. This is much like rigid conduit, but is lighter, requires no threads, and is usually accepted by the inspectors.

MAGNIFIER AIDS IN STUDYING FINE DETAILS OF DRAWING

MANY uses for a magnifier or reading glass in the home workshop have been mentioned, but there is one in particular that is sometimes invaluable. Used for studying small working drawings, a good glass will reveal many details that are likely to escape the naked eye. Whenever you have difficulty in figuring out just what some minute detail means, examine it under a magnifier.

The reason why you can see so much more in this way is because the average working drawing, while quite large in its original form, must be reduced greatly to fit the available space on a magazine page. Some of the finer details are then likely to be so small that the lines appear to run together. Under a magnifier, however, these details become quite distinct and readable.

Inserting the lamp into the sockets at top and bottom



TRY P.A. ON THIS MONEY-BACK GUARANTEE!

SMOKE 20 FRAGRANT PIPEFULS OF PRINCE ALBERT. IF YOU DON'T FIND IT THE MELLOWEST, TASTIEST PIPE TOBACCO YOU EVER SMOKED, RETURN THE POCKET TIN WITH THE REST OF THE TOBACCO IN IT TO US AT ANY TIME WITHIN A MONTH FROM THIS DATE, AND WE WILL REFUND FULL PURCHASE PRICE, PLUS POSTAGE.

(Signed) R. J. Reynolds Tob. Co., Winston-Salem, N. C.



THAT PRINCE ALBERT 'CRIMP CUT' CERTAINLY PACKS AND DRAWS TO PERFECTION



ALSO TRY ROLLING YOUR OWN WITH P. A.

Copyright, 1937, R. J. Reynolds Tobacco Company

PRINCE ALBERT
THE NATIONAL JOY SMOKE



Here's your answer

Men—we've made another great advance in shaving. Instead of producing one shaving cream that would try to fit everybody, we are now making *two* Mennen Shaves, one for the man with *oily* beard and skin, one for the man with *dry* beard and skin.

Mind you, *everybody's* face tends either toward oiliness or dryness. *Your* face, too. In other words, one of the Mennen Creams is *made for you*. Mennen Lather Shave removes excess oil, so that the lather and water can soak into whiskers quicker and wilt 'em more completely; and it cleanses the pores. But Mennen Brushless conserves the natural oil and relieves dryness, and tautness; and it's a cream, not a grease.

You owe it to yourself to find out which Mennen Cream fits *your* face. Send 10c for the Mennen Skin Tester Kit, containing liberal demonstration sizes of 5 Mennen Products—including both Lather Shave and Brushless (as well as Skin Bracer, Skin Balm and Talcum for Men). Address Dept. PS6, The Mennen Co., Newark, N. J.



TOOLED - LEATHER

Book Ends

FOLD FLAT
FOR TRAVELING

By
*John Stewart
Wilcox*



Left: One book end in use, another folded. Above: The background is decorated with a ball-peen hammer



ADMIRABLY suited to the book-loving traveler and equally satisfactory for use at home, these tooled leather book ends take up little space when folded flat, yet expand to hold any shelf of books.

The materials, costing less than a dollar, are: 1 pc. 7-in. square tooling steer, color to suit; 1 pc. 8-in. square lining leather, color to match; 1 pc. cheap leather for the bottoms, a right triangle 7 in. on the sides, color to match; and about 9 yd. of $\frac{1}{8}$ -in. lacing, color to match. In the absence of modeling tools, a nut pick will do; and in place of a punch, a hammer and flattened nail will serve. Rubber cement, cellulose household cement, liquid shoe polish for dyeing edges, and wax shoe polish also are needed.

The tooling steer is tempered by soaking it in water for half an hour, draining, rolling it in waterproof paper, and leaving it overnight. Then lay it in the open air in a cool, shady spot, hair (finished) side up, and allow to dry until the hair side looks dry. It is now in perfect shape for tooling.

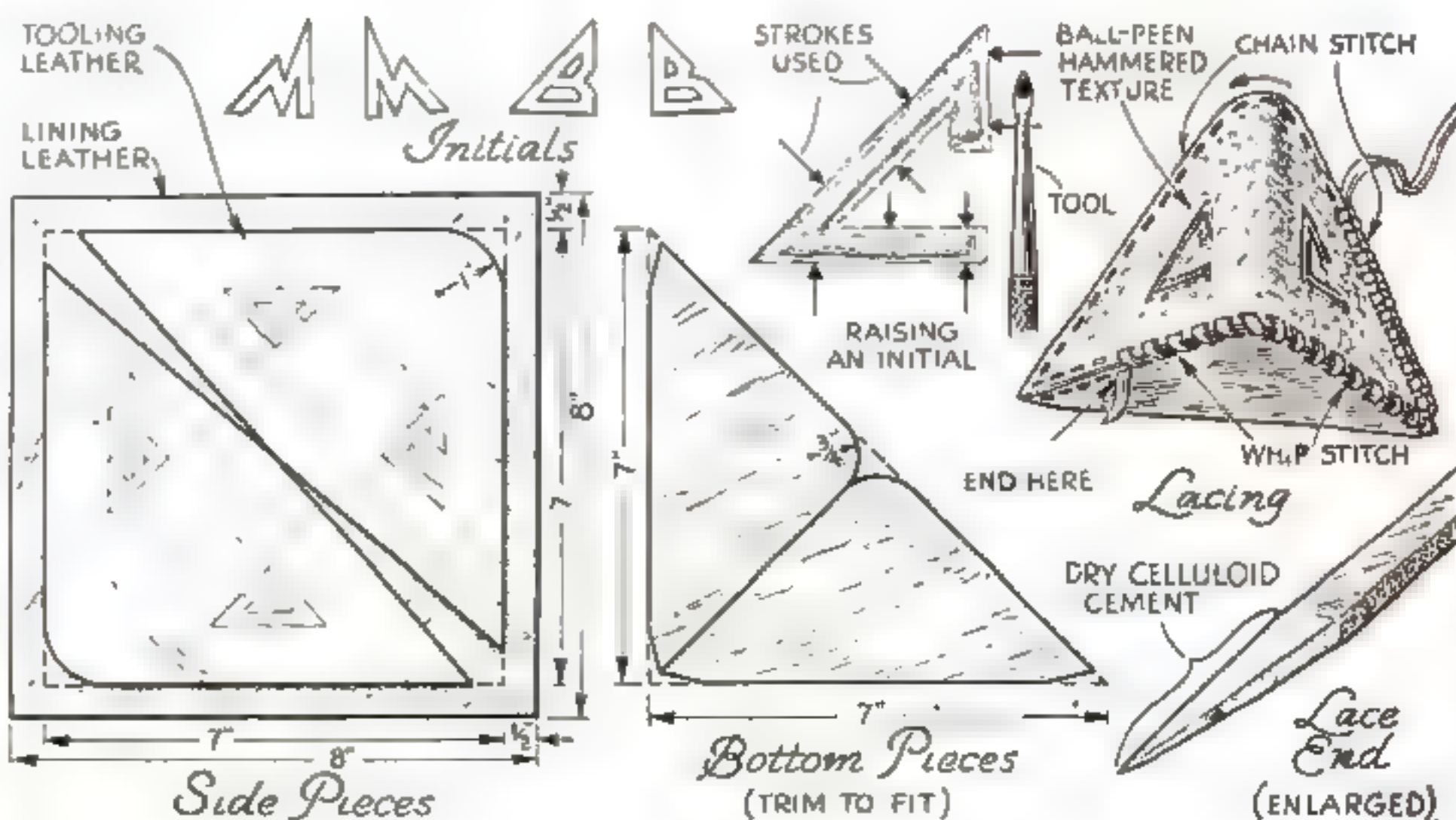
Carefully transfer your initials, monogram,

or other design to the leather. To raise the design to the maximum, start with a blunt modeling tool and work the depressed areas towards the raised portions. Finish with a "deer's-foot" or other flat-surfaced, sharp-edged modeling tool. To get an effective background, simply hammer lightly as you would metal, using a ball-peen hammer weighing from 2 to 4 oz.

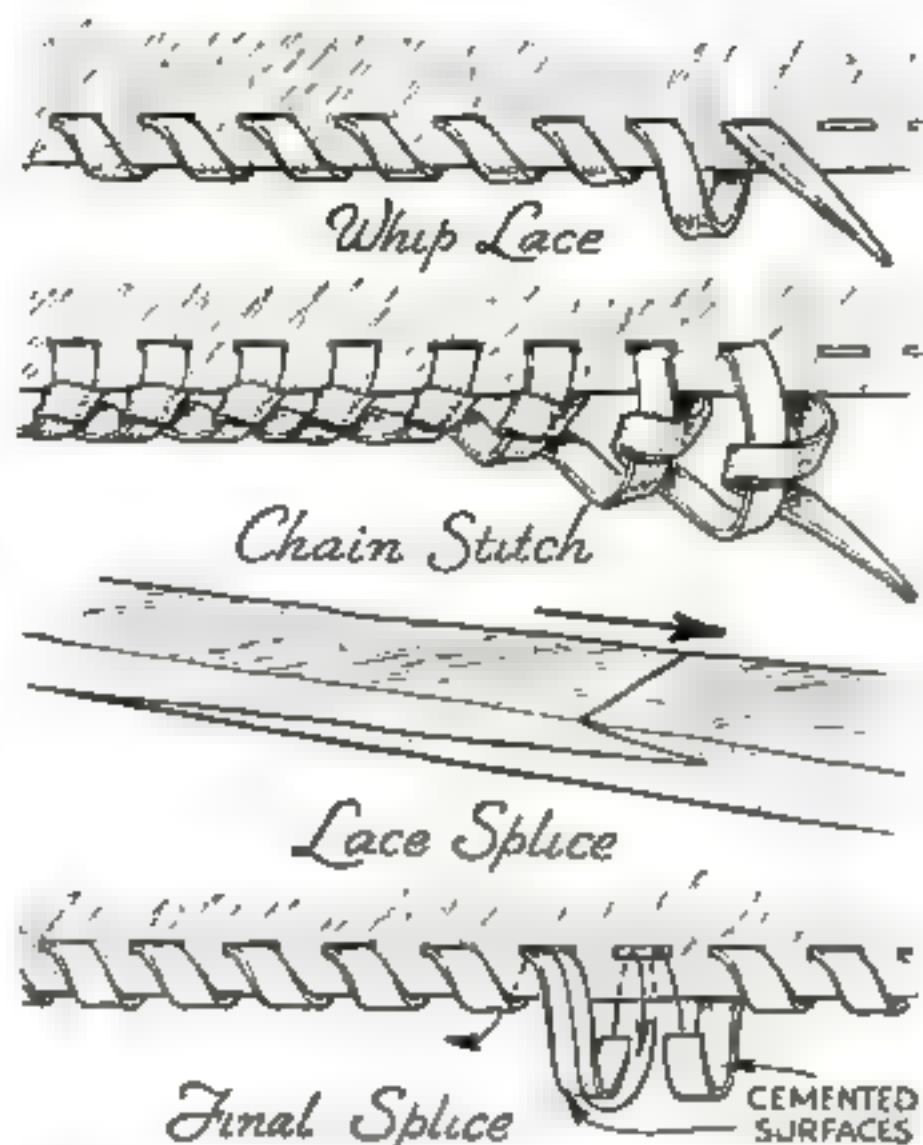
Allow the pieces to dry flat, then coat the flesh sides of the tooled and lining leathers with a celluloid cement and press firmly together, avoiding any air bubbles. Cover with waxed paper, pad with a folded bath towel, and weight the whole to keep it flat while drying. Allow four hours to dry. Then trim off the margin of lining leather, mark as shown in the drawing, and cut apart.

Divide the triangular bottom piece as indicated and round the right angles of the two parts to a radius of about $\frac{3}{4}$ in. Fit these bottoms to the tooled portions, making sure the corners fit. Stain all edges and polish the hair surfaces.

Punch the tooled portions for lacing, leaving a gap between punchings and a margin equal to the width of the lacing, as in the lacing sketches. The lacing required will be about seven times the distance around the piece. Draw the lacing over a piece of beeswax or paraffin a few times, taper both ends



The parts, typical initials, how tooling is done, a pointed lace end, and process of lacing



Whip lacing, the hair side always being kept out; chain stitch, lace splice, and final splice

of the two pieces, each 2 yd. long, rub these ends with celluloid glue, and allow to dry until hard, thus forming a needle on each end.

Mark and punch a few holes at the $\frac{3}{4}$ -in. radius of one bottom piece. Place the bottom in position against the tooled part, and start whip lacing at the radius. Lace left about 3 in., punching as you go; then stop and lace toward the right, continuing to the point. Chain stitch from there on all around to the other point, and whip lace the short distance remaining from the point to the final splice.

When necessary, lacing may be spliced as shown. Notice the little flap of the right piece (new lacing) that holds the leading point of the left piece and draws it through holes. Cut your lacing as sketched, paint joining faces with rubber cement, let it dry, join the splice, and proceed with the lacing.

For the final splice, skive the hair surface of the left end and the flesh side of the right, paint with rubber cement, dry, thread the left end through first, then pull the right tight on top of it and trim.



When the lacing is complete, the initials may be touched up with a final light tooling

COATED WELDING RODS

INEXPENSIVE bare welding rods may be satisfactorily coated for use with arc welders of the transformer type. Place 1 qt. slaked lime in a 1-gal. can or bucket. Fill the quart measure two-thirds full of boiling water and dissolve a teacupful of soap chips. Add this to the lime. Then add 1 qt. silicate of soda (water glass). Mix thoroughly. Add water until the dip is of the consistency of thick batter. Notch a small strip of wood to take the ends of the rods and hold them with a second wood strip. Submerge the rods in the dip up to the stick, then lean them against a wall to dry. The part of the rod held in the stick is free of dip and will make good contact in the holder.—W. C. CHENEY.

Protect PRICELESS EYESIGHT with G-E MAZDA Lamps



Eyestrain begins when children are even younger than those in this picture . . . and it persists throughout life.

On an average, only 3 out of 5 children reach college age with normal vision; and only 2 out of 5 reach forty with good eyesight.

Protect your family: 1. Have their eyes examined regularly, and corrected if necessary; 2. Give them plenty of good light.

A very important step in securing good lighting is to use only good lamp bulbs. Insist on MAZDA lamps made by General Electric. Inferior substitutes often waste much of the light you pay for . . . and need for seeing safely.

Look for the G-E mark on the bulb and you will be sure to get lamps that do not waste electricity and that STAY BRIGHTER LONGER.



60-WATTS AND SMALLER

G-E ALSO MAKES A LAMP FOR 10¢
If you buy ten-cent lamps, get the best. They're marked G-E and come in 7½, 15, 30 and 60-watt sizes. Try some today.

GENERAL ELECTRIC MAZDA LAMPS

MAKE EACH PROJECT A STEP AHEAD



NICHOLSON Files will help you

You are one of the modern home craftsmen who always looks forward to making something more difficult, more beautiful, more useful. . . .

The new Nicholson Files will help you take each step ahead more quickly, surely and easily.

Tests prove these modern files, made on a new and different principle of tooth construction, remove far more stock, stay closer to the line of work, file faster and cost less to use.

Try Nicholson Files now. Let them help you with your summer projects. These files are first choice among expert home craftsmen and experienced filers in the industrial field.

Your hardware store can supply you. Nicholson File Company, Providence, R. I., U. S. A.

Patents  Pending

FILES FOR SMALL, ACCURATE WORK . . .

Ask us about Nicholson X.F. SWISS PATTERN FILES—Set of 1 dozen assorted 6 1/4" knurled handle needle files in a wooden box which, with top removed, serves as a convenient holder on the work bench



A FILE FOR EVERY PURPOSE

WHAT A HOME WORKSHOP CLUB IS LIKE

(Continued from page 81)

are proud of their work, and 55 percent of the clubs held exhibitions last year in order to display their projects and to interest others in the hobby. In many cases the exhibit was in a store window, although often it was part of a hobby show or a county or state fair. A few of the clubs were able to run extensive shows of their own.

More than half the clubs are interested in some civic activity. Although complete records were not available, the Guild estimates that more than 5,000 toys were made by home workshop clubs and distributed to poor children last Christmas. Other clubs have attempted more ambitious projects such as building a cabin for Boy Scouts (Rockford, Ill., Homecraft Club), building tables for a crippled children's hospital (Chickasaw Homeworkshop Club of Memphis, Tenn.), constructing a shop for a children's home (Fargo, N. Dak., Homecraft Guild), donating equipment to a local school (Creston, Iowa, Homeworkshop Club), holding an annual auction to raise funds for needy children (Jacksonville, Fla., Homeworkshop Club), and presenting a tool each school term to the outstanding manual-training student (Wood-Ridge, N. J., Homeworkshop Club).

Home workshop clubs are located in 43 states, Canada, and the Philippine Islands. Most of them are in the more densely populated areas, although there are also many scattered about rural sections. The members follow a wide variety of occupations. A bank president or dentist may work hand in hand with a bricklayer or mechanic in order to turn out some beautiful piece of furniture or make toys for poor children.

The typical member, as found out in the first Guild survey, is 35 years old. His shop is in the basement and can be lighted and heated. He spends 11 1/2 hours a week in his shop, and his equipment consists of five machines and fifty hand tools. He has invested \$190 for these tools and machines, and spends \$128 a year for wood, tools, hardware, paint, metal, and miscellaneous supplies. More often than not, he has never worked in a skilled trade. His education is better than average and it is almost a one-to-two chance that he went to college and a one-to-four chance that he holds a college degree. He maintains his shop principally for enjoyment, but partly for making repairs and other profitable work. POPULAR SCIENCE MONTHLY is his favorite magazine.

WORKSHOP CLUBS REPORT ACTIVITIES

THE Great Falls (Mont.) Homeworkshop Club has been making a ship's wheel for a boat the Boy Scouts use in going to Scout Island in the upper Missouri River for camping trips. A light lunch is served at each meeting, and the average attendance is nineteen. Tools and supplies are purchased by the club in quantities for the convenience of the members, and a library of catalogues is available to assist them in selecting materials. Officers are Jack Creek, president; Albert Wolf, vice president; E. S. Epley, secretary; E. W. Luther, treasurer; C. A. Shelton, Edgar Suhr, and C. O. Carlson, board of governors.

"House Repairs" was discussed by the Tri-City Homeworkshop Club of LaSalle, Peru, and Oglesby, Ill., at the home of Earl Gealow. Plans were made for a picnic and exhibition. Prizes will be awarded by the hardware store in the windows of which the display will be placed. Recent meetings have included a talk on woodwork by Floyd Hockings, demonstration of wood dyeing by Charles Korn, talk on making tools by Walter Menning, and a demonstration of linoleum carving by Dan B. Jones.

Various arrangements of home workshops were discussed by the Crookston (Minn.) Homecraft Club at the local public library, after which the members visited the shop of the Rev. Elmer Johnson.

Carol O. Rogers has been elected president of the Newcastle (Calif.) Homeworkshop Club; Patroculus F. J. A. Hirsch, secretary-treasurer; Emile V. Saladana, Andy H. Ebert, Gordon Kister, and John Dunnett, board members. The club was represented at the Sacramento State Fair with a display by Mr. Hirsch. This was not in competition for a prize, but received honorable mention nevertheless. The group cooperated with the Newcastle Lions Club by making signs advertising a playlet . . . Three game tables are being made by the Oneonta (N.Y.) Homeworkshop Club for the Y.M.C.A. where semimonthly meetings are held. Duncan Briggs exhibited and talked on cabinet woods at a recent session. Kenneth Bennett, Duncan Briggs, Charles Nichols, and Floyd Crandall form the board of governors.

"Forest Treasures," a sound moving picture about veneer woods, was exhibited to the Bartlesville (Okla.) Homeworkshop Club.



Some of the members of the Premier Homeworkshop Club, Chicago. The wood carvings are by Wilfred Gast (right end of front row)

Plans for an exhibition were discussed. . . The Homecraft and Modelmakers' Guild of Richmond, Va., has changed its meeting place from the Virginia Mechanics Institute to the Central Y.M.C.A. All home workshop clubs in Virginia are invited to participate in the annual exhibition to be held soon. . . The Springfield (Mass.) Model Yacht Club has twelve new boats of the 50-800 class under construction. . . Many types of woodworking, metal working, and photography were on display at the exhibition of the Premier Homeworkshop Club of Chicago, Ill., at River Park Field House. . . Moving pictures were shown to the Creston (Iowa) Homeworkshop Club at the home of Dr. Carl Sampson.

A clubroom and workshop is being equipped by the Pittsfield (Me.) Craftsmen's Homeworkshop Club for its members. Arrangements have been made to purchase a moving picture projector and maintain a library. An exhibition will be held soon. Officers are William T. Russell, president; Edward Poulin, vice president; Cyril Poulin, secretary-treasurer, and Roger Parenteau, librarian.

Meetings of the Staley Handicraft Club of Decatur, Ill., are held in the club workshop three times a week under the supervision of experienced instructors. Membership has increased to forty-one. Most of the men are interested in cabinet- (Continued on page 97)

WORKSHOP CLUB NEWS

(Continued from page 96)

making, woodworking, and model making.

Wood finishing, the use of wood turning tools, and archery were among the topics discussed at recent meetings by the *Findlay (Ohio)* Homecraft Club. E. H. Burnap has been elected president to succeed E. L. Smith, who moved away. Other officers are K. P. Brewster, vice president; A. J. Peschel, secretary-treasurer, and L. C. Secrest, librarian.

The North Shore Craftsman Club, *Waukegan, Ill.*, has purchased a large wall case where members can display their projects. An exhibition is being planned, and clubs in the surrounding territory are invited to participate. . . A course in industrial drawing is being conducted by J. F. Thériault for the Club des Artisans Amateurs, *Trois Rivières, P.Q., Canada*. The Rev. Albert Tessier showed five moving pictures at a meeting which 125 mem-



One section of large display by the Richmond, Va., club in the City Library Building

bers and friends attended. . . The *Winfield (Kans.)* Homeworkshop club discussed "Home Repairs" under the leadership of Harold S. Wortman at the workshop of Louis A. Robertson. The latter demonstrated the use and care of a spindle shaper. . . Methods of building workbenches were studied by the Gem City Homeworkshop Club, *Dayton, Ohio*. . . James A. Oberly has been elected president of the *Wilmington (Del.)* Homecraft Club; Charles R. Barbon, vice president, and George W. Longacre, secretary-treasurer. The club inspected the workshop of Mr. Oberly and outlined a program for the next ten months. . . The Society of Model Engineers, *Ottawa, Ont., Canada*, hopes to have its model railway layout completed for display at the Central Canada Exhibition in August. . . Woodcraft, metalcraft, taxidermy, printing, and bookbinding are the hobbies followed by members of the "City of Lights" Homeworkers Guild, *Aurora, Ill.*

Earnest Elmo Calkins, author and advertising man, has been made a member of the *Galesburg (Ill.)* Homeworkshop Club. A lecture on paints and varnishes was recently given, followed by a trip through a factory making such products. The members have made a kitchen item which they are selling to raise funds for the club's building program.

The Cartier Homeworkshop Club of *Montreal, P.Q., Canada*, has been making and mending hockey sticks for children. The club photographer is making a compact developing outfit for camping trips. . . A kite tournament interested the Custer Homeworkshop Guild of *Miles City, Mont.*, during April. . . W. C. Avey demonstrated wood turning for the Homeworkshop Club of *San Antonio, Texas*. The club has made arrangements so that members can use the shop of the vocational school.

Talks and demonstrations are given each week by the different divisions of the Sunset Social and Hobby Club, *Brooklyn, N.Y.* Heads of committees follow: electrical, James Arnish; technical (Continued on page 98)



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HITS

WORKSHOP CLUB NEWS

(Continued from page 97)

aviation, Ben Amodeo; practical aviation, Edward Korsberg; Diesels, Charles Ward; tool making, Benjamin Finnberg; stamp collecting, James Arnish; photography, Ivan Finnberg.

"Glues and Gluing" was discussed by Clyde Ford at a meeting of the *Racine (Wisc.)* Homeworkshop Club held at the home of Steve Steibel. Walter F. Scholtz demonstrated glass blowing, pulling, and welding. Recently the club visited the home of Mr. Cole to inspect his miniature village. It is made of cigar-box wood and includes scale models of all the principal buildings of Racine.

Industrial moving pictures are shown at every other meeting by the *Louisville (Ky.)* Homeworkshop Club. The annual exhibition was canceled because of flood conditions, but a contest will be held instead. More than 150 toys were made for poor children last year. Officers for 1937 are I. J. Kistner, president; E. J. Schwartz, vice president, and E. F. Schmidt, secretary-treasurer.

A bird house contest was held by the *Ware (Mass.)* Homeworkshop Club during March. Ed Gossehn demonstrated how to develop photographs. . . Jacob Markow, president of the *St. James Workshop Club of Montreal, P.Q., Canada*, has obtained a sound moving picture projector, which will be used at future meetings. . . The *South Shore Homeworkshop Club of Quincy, Mass.*, has obtained the services of a manual arts instructor, who is devoting his time gratis in the club's behalf. . . A round-table discussion of shop problems was held by the *Oklahoma City (Okla.)* Homeworkshop Club. . . H. J. DeVaut, president of the *Domestic and Juvenile Officers' Homeworkshop Club, Toledo, Ohio*, is instructing a Boy Scout troop in handicraft. The club members have started a model railway and ship program.

Recent meetings of the *Handicraft Club of Milwaukee, Wisc.*, have included demonstrations on high-speed router bits and hand bits, and on making window sash with a shaper; also lectures on care and use of oilstones, and circular and band saws. The programs were arranged by George Smith, the president, and Bob Melius. Attendance has been excellent as a result.

START A WORKSHOP CLUB IN YOUR NEIGHBORHOOD

DO YOU know four friends and neighbors who are interested in the home workshop hobby? If you do, the National Homeworkshop Guild will help you organize a club so that you can participate in the many free benefits provided. Any group of five or more persons who are at least sixteen years of age will be recognized by the Guild, if the members agree to follow a few simple regulations.

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There are also tested plans for many other types of projects, including ship models, radio sets, furniture, and novelties. In most cases the blueprints measure 15 by 22 in. When ordering it is necessary to give only the blueprint numbers. If there are two or more numbers for a single title, it means that there are two or more blueprints in the complete set. The letter "R" indicates that special instructions are included.

A partial list of blueprints is printed below. If you do not see what you want, send a stamped, self-addressed envelope for the complete list.

MODELS

	Barnegat Lighthouse, 298A.....	.25
	Bluenose, famous fishing schooner, 17½-in. hull, 110-111-112-R	1.00
	Brig <i>Malek Adhel</i> (20-in. hull; frame-and-plank construction), 304-305-306.....	1.00
	Civil War Ships <i>Monitor, Merrimac, and Hartford</i> (3½, 5½, and 5½ in. long respectively), 258.....	.25
	Clipper Ship <i>Great Republic</i> (31½-in. hull), 272-273-274-R.....	1.25
	Clipper Ship <i>Sovereign of the Seas</i> (20½-in. hull), 51-52-53-R.....	1.00
	Coast Guard Patrol Boat (20½-in.), 286-287-R.....	.75
	<i>Constitution</i> ("Old Ironsides"), 21-in. hull, 57-58-59-R.....	1.00
	Cruiser U.S.S. <i>Indianapolis</i> (12-in.), 216....	.25
	Farragut's Flagship <i>Hartford</i> (33½-in. hull), 221-222-R.....	1.50
	Freighter, <i>Ocean</i> (14-in.), 271.....	.25
	Galleon <i>Revenge</i> (25-in.), 206-207-208-209 ..	1.00
	Gettysburg Cannon (11½ in. long, 3/32-in. scale), 292A-293A.....	.75
	<i>Hispaniola</i> (7-in.), 237.....	.25
	H. M. S. <i>Bounty</i> (8½-in. hull), 254.....	.25
	Liner <i>Normandie</i> (20½-in. hull), 264-265....	.50
	Liner <i>St. Louis</i> (11-in.), 231.....	.25
	<i>Nourmahal</i> , power yacht (8½-in.), 276.....	.25
	Oil Tanker (14-in.), 294.....	.25
	Racing Yacht <i>Seascout</i> (42-in.), 106-107-R....	.75
	Roman Galley (19-in.), 138-139-R.....	.75
	Scenic Half-Model of <i>Barque</i> (13½-in.), 108	.25
	<i>Sea Witch</i> , Clipper Ship (9½-in. hull), 219	.25
	Ship Model Weather Vane, 66.....	.25
	Show Boat (14-in.), 263.....	.25
	Stagecoach with Horses, 144-145-146-R.....	1.00
	Toy Motorboat (29-in.), 63-64-R.....	.75
	Tugboat, Harbor (11½-in.), 284.....	.25
	U. S. Battleship <i>Texas</i> (3-ft. hull), 197-198-199-200.....	1.00
	U. S. S. <i>Tuscaloosa</i> (11¼-in.), 234.....	.25
	Viking Ship (20½-in.), 61-62-R.....	.75
	<i>Winnie Mae</i> , 4-ft. Flying Scale Airplane Model, 141-142-143.....	.75
	<i>Yacht Rainbow</i> (7½-in. hull), 233.....	.25

(Construction kits are available for some of these models. See page 15.)



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R.....

(Continued on page 99)

TESTED WORKSHOP PLANS

(Continued from page 98)

Amateur Short Wave Receiver, 155.....	.25
Amateur Radio Transmitter, 183-184.....	.50
Five-Tube Short Wave (A.C. or D.C.), 223.....	.25
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Modernistic Lamps (three designs), 93.....	.25
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Outboard Racer for Class "A" and "B" Motors, (10 ft. 4 in. long), 211-212-R.....	.75
Racing Runabout (13 ft. long, for outboard motor), 261-262-R.....	.75
Runabout Sportboat (15 1/4 ft. long with detachable top, seats that fold into bunks, etc.; for use with outboard or inboard drives), 175-176-177-R.....	1.00
Sailboat (12 ft. long; weighs 200 lb.; has fast skimming-dish hull), 314-R.....	.50
Sport Runabout (9 ft. 8 in. long, 43-in. beam, for small outboard motors), 309-310-R.....	.75
Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R.....	.50



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Garden Trellises and Sundial Post, 34.....	.25
Log-Cabin Bird House, 244A.....	.25
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Modernistic Desk Clock; also information on cutting and etching metal with acid, 282A.....	.25
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Projector for Photos and Pictures, 259A.....	.25
Question-and-Answer Game, 302A.....	.25
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Simple Jewelry Designs, 298A.....	.25
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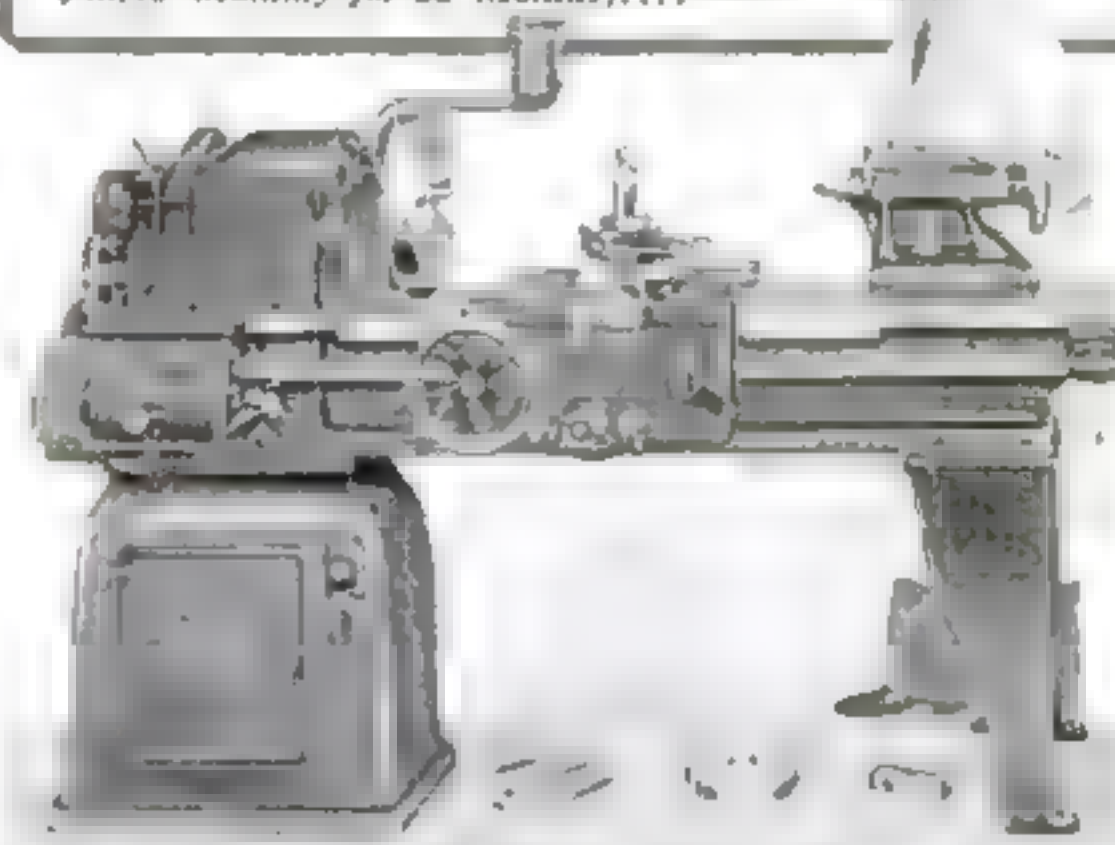
THE new 1937 model 9-inch Workshop Precision Lathe is a back-gear Screw Cutting Lathe and is recommended for the finest, most accurate jobs in manufacturing—in the tool room, in home workshops and automotive machine shops. Features include Twin Gear Reverse to load screw, Ball Thrust Bearing on Spindle, Longitudinal Screw Feed to Carriage, Precision Lead Screw for Cutting screw threads—and scores of other important features. Takes 38 practical attachments for milling, grinding, draw-in collet chuck work, and many other manufacturing jobs.

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UniveX CINE 8

HOW TO GET GOOD SHOTS WITH A SMALL CAMERA

(Continued from page 90)

much greater degree of enlargement necessary with the tiny negative. Remember that enlarging brings out the defects in a negative as well as its good points.

The poorer the light conditions and the nearer you are to your subject, the more necessary it is to focus accurately. When you are working closer than ten feet with a large lens opening, be especially careful to get the focus exactly right if you expect to enlarge the resulting negative.

The other cause of fuzzy pictures is camera wobble at the moment when the shutter is released. Miniature cameras are particularly subject to this trouble because of their light weight and small size.

THERE are two remedies. One is never to use a slower snapshot speed than a hundredth of a second. While this may be the only practical solution for the man who is exceptionally nervous and shaky, it has virtually the same effect as though you used a lens of only one fourth the speed. In other words, if you have an F/3.5 lens but must work at a hundredth of a second, you can't take a snapshot under any poorer light conditions than the chap who can hold steady down to a twentieth of a second and who has only a cheap folding camera with an F/8 rapid rectilinear lens on it! And if you can hold a twentieth of a second, you can do as well with your F/3.5 lens under poor light conditions as the shaky fellow with a hundredth of a second minimum and an F/1.5 lens!

So it stands to reason that if you want to get the most out of your miniature camera, no matter what its lens equipment, you must practice until you can hold rock steady for the slower snap speeds.

The way you hold the camera has a lot to do with it. While the position of the shutter release and the shape of the various types of miniature cameras make it impossible to give specific advice, the general rule is to get as many points of support as the shape of the camera and your own contours permit. If possible, hold the camera firmly with the right hand so that the shutter-release finger can do its job smoothly and without a jerk. Try to get your cheek against the back of camera, and if you can't do that and still look through the finder, the end of your nose makes an acceptable substitute for your cheek.

The commonly accepted position for the hand that doesn't work the shutter release is a plain tight grasp of the camera body. However, that is not necessarily the steadiest position. Note how the photographer in the illustration at the beginning of this article is holding the camera. The left hand, instead of grasping the camera, is turned edgewise and forms, in effect, a right-angle shelf with the camera supported clear out to the front of the lens. This position was developed for use with long-focus lenses and is surprisingly steady. The same idea with only slight modifications works nicely with any of the folding types of miniature cameras where the front cover folds outward to a position at right angles to the camera body.

IF YOU don't believe this position is much steadier than the regulation one, the next time you look through a field glass try placing the left hand as shown and see how the image stops jittering around.

The processing of miniature camera negatives, while it follows the same system used for larger negatives, is a very much more delicate and difficult job. In the first place, special developers must be used if you expect to enlarge your negatives up to as much as 8 by 10 in. Some of the finest of these developers come ready pre-

(Continued on page 114)

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POPULAR SCIENCE MONTHLY

CLIP HOLDS KEYS SECURELY IN POCKET

KEYS will never fall out of one's pocket if kept as illustrated. An ordinary belt hook for keys is used in a reversed position—that is, the key ring is slipped over the inverted clasp which is intended to hook over a belt. The other part of the hook, originally designed to hold the key ring, is snapped over a large safety pin, which is fixed firmly inside the pocket on the side next the body. The hook with the keys can be removed instantly from the safety pin by pressure of a finger on the snap.

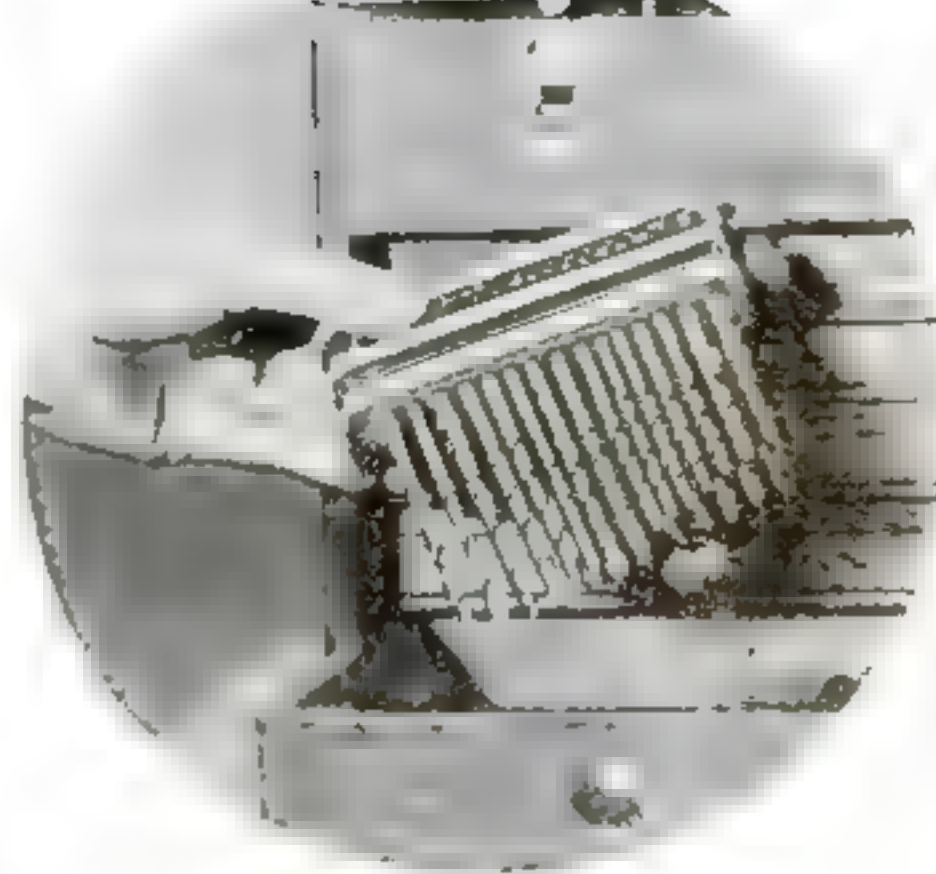
The automobile key is not placed on the ring, but on a special wire loop made as shown.



How the keys hang on a safety pin in pocket

This loop slides over the belt hook and rests on top of the key ring. The car key then can be slipped off the hook as it hangs in the pocket, leaving the other keys ready for use and not dangling from the ignition lock where, except in the case of certain cars having spring locks, they cannot be used—even the garage-door key—without stopping the engine.

Note particularly how the safety pin is fastened. Unless the pin is put in the cloth so that it has several points of support, instead of two, it will tear the pocket and turn vertically.—H. K. RANDALL.



The drills are kept from falling by sponge rubber placed between two tiers of the stand

GRAPEFRUIT KNIFE USED FOR STICK SHELLAC

A GRAPEFRUIT knife with the usual curved, tapering blade makes an excellent tool for the application of stick shellac when "burning in" damaged spots in finishes on furniture or other woodwork. Select a knife with as flexible a blade as possible. Care should be used, of course, not to overheat the blade and impair its temper.

An alcohol lamp is best for heating the knife because it gives an intense, smokeless flame. One may be made from a cheap copper oil can 3 or 4 in. in diameter. Cut off all but $\frac{1}{2}$ in. of the spout and drill a $\frac{1}{32}$ -in. air-inlet hole in the screw top. A piece of cotton rag, rolled up and stuffed in the spout, will serve as a wick and should reach to the bottom of the lamp.—ARTHUR L. D. FORD.



RULING CARDS QUICKLY

WITH a pattern card cut as shown above and held together at the bottom by means of a piece of gummed paper, a number of file cards can be rapidly ruled to suit any special purpose.—HARRY E. WOOD.

SPONGE-RUBBER INSERT IMPROVES DRILL STAND

MY TOOL chest, like those of most machinists, has no place for a set of number drills in their stand. I tried placing the stand on its side in one of the deeper trays, but the drills, particularly the smaller ones, spilled out and became lost whenever the tray or the chest was moved.

To overcome this, I bought an ordinary household kneeling pad of sponge rubber and cut out a piece of a size to fit between two of the tiers of the drill stand. Holes for the drills were punched with the drills themselves in punch-press fashion. The soft rubber holds the drills firmly, and the stand can even be turned upside down.—R. J. SHIBLES, JR.

SWELL NEWS!

ARTHUR MURRAY
World's Greatest
Dance Instructor—
Tells you how to do
the very Newest
DANCE STEPS
FREE!

Start Now to Clear up Your Skin! Learn the New Steps! *BEPOPULAR*

THESE FANCY DRESS SHINDYS ARE GREAT UNTIL THEY TAKE THE MASKS OFF—THEN I'M A FLOP LOOK AT THESE PIMPLES! I'M NOT GOING—

SAY! FLEISCHMANN'S YEAST WILL HELP CLEAR THEM UP—IF YOU STICK TO IT—3 CAKES A DAY

NEXT DAY: HERE YOU ARE SON GOT THE YEAST CAKES. THE GROCER GAVE ME THIS CARD TOO. LOOKS QUITE INTERESTING

INTERESTING IS RIGHT LOOK MUM YOU JUST PASTE YEAST LABELS IN HERE AND GET A BOOK OF LESSONS BY ARTHUR MURRAY ON THE LATEST DANCE STEPS!

4 WEEKS LATER: JOE MAILED FILLED-IN CARD FOR DANCE BOOK

FEW DAYS LATER: YOUNGSTERS WANT FOOD

CAN'T STOP NOW, MUMS WE'RE LEARNING SOME NEW STEPS FROM JOE'S DANCE BOOK. IT'S THRILLING!

CHOW LET'S TRY THAT FOX TROT STEP NOW. THE WESTCHESTER BOY NEVER KNEW DANCING WAS SO EASY

JOE'S A KNOCKOUT IN THAT OUTFIT! AND GOSH—LOOK AT THAT STEP HE'S DOIN'!

ISN'T HE GRAND IT WAS JUST SWELL HOW FLEISCHMANN'S YEAST HELPED CLEAR UP THOSE KICKLES OF HIS!

ASK YOUR GROCER FOR THIS FREE FLEISCHMANN DANCE CARD

● Don't slip upon this big chance, boys and girls! Begin this very day to save yeast labels for Arthur Murray's EXCITING book of 20 dance lessons!

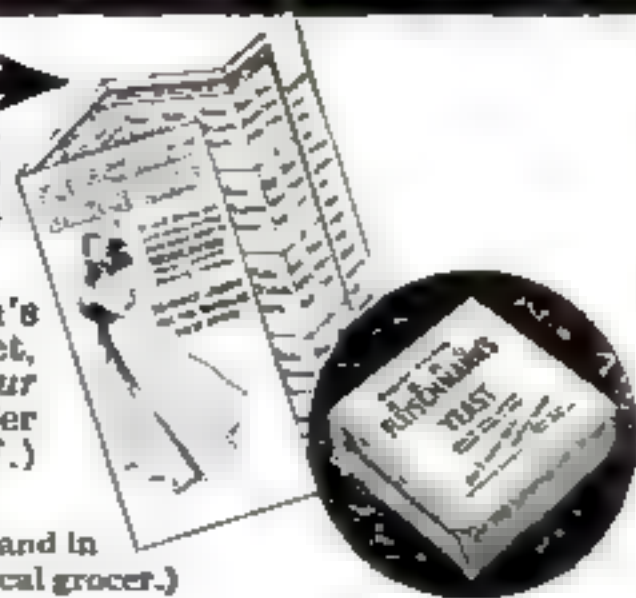
You CAN'T BUY this book! The only way to get one is with Fleischmann Yeast labels.

Eat 3 cakes of Fleischmann's Yeast daily for 27 days. Save label from each cake. Paste these on free Fleischmann Dance Card. Your grocer will give you. Send it in!

If your grocer has no Dance Cards, save your 81 yeast labels and send them in an envelope, or pasted up on plain paper.

Send labels to Fleischmann's Yeast, 701 Washington Street, New York City. Include your name and address. (This offer holds good until August 31, 1937.)

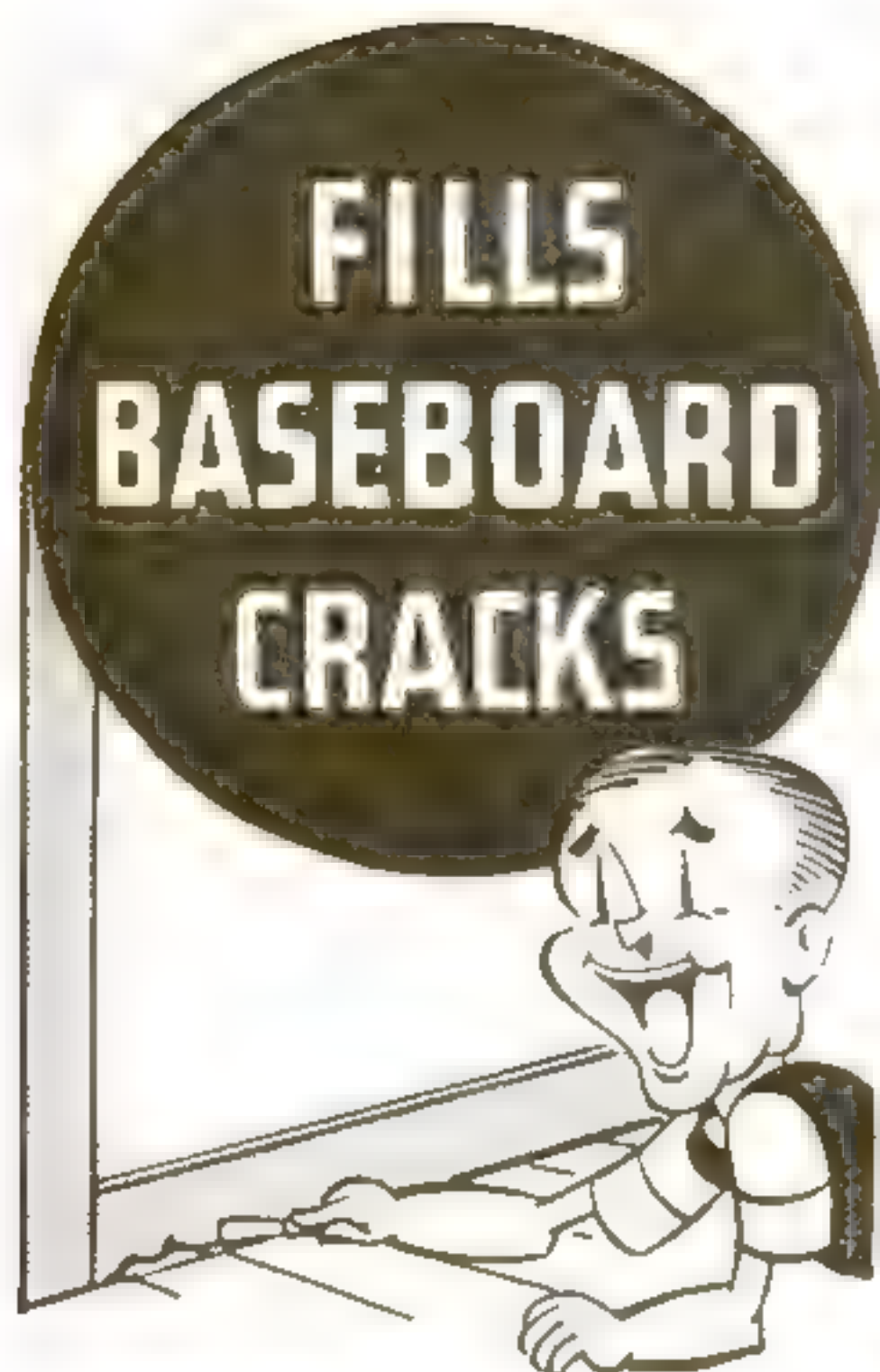
(Details of securing Dance Book differ slightly in states west of Denver and in Canada; see newspapers, or ask your local grocer.)



"KEEP EATING it regularly," says Dr. R. E. Lee, well-known physician, "and Fleischmann's Yeast will help clear up ADOLESCENT PIMPLES"

● After the start of adolescence, the body is changing, maturing. Important glands develop, causing disturbances in the system. The skin gets oversensitive. Waste poisons in the blood irritate this sensitive skin. Pimples break out. Fleischmann's Yeast helps to overcome adolescent pimples by clearing these skin irritants out of the blood. Eat 3 cakes every day—a cake about $\frac{1}{2}$ hour before meals—plain, or in a little water. Start now!

Copyright, 1937, Standard Brands Incorporated



Makes 1001 Household Repairs

Baseboard Cracks Drainboard Cracks
Loose Casters Loose Bathroom Fixtures
Old Nail and Screw Holes Loose Tiles
Repairing Screens Pattern Making
Floor Cracks Cracked Porcelain
Modelling:—Amateur—Professional

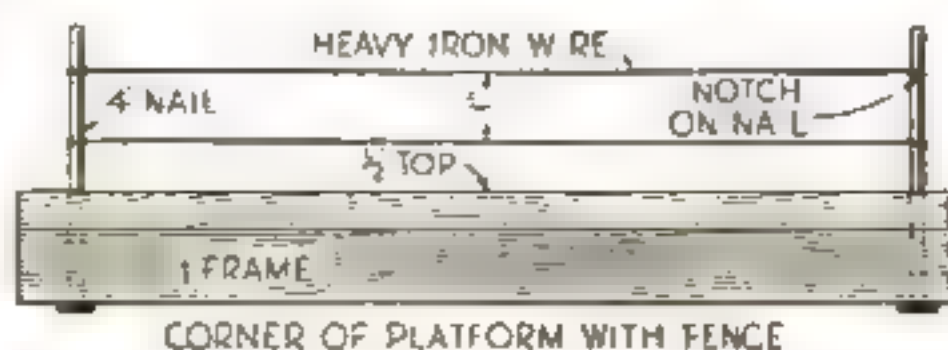
Genuine Plastic Wood makes household repairs so easily yet permanently—this wood in putty form dries to hard wood—when dry it can be sanded, sawed, carved; will hold nails and screws perfectly without chipping or cracking. Genuine Plastic Wood is waterproof and weatherproof and will adhere to any clean, dry surface—wood, metal, stone, glass or porcelain.

Anyone Can Use Plastic Wood

Genuine Plastic Wood is easy to use—comes in nine different colors to match any object repaired. Its soft putty form makes it easy to make repairs. Children even use Genuine Plastic Wood to model lifelike objects. Keep it handy. Sold at all paint, hardware and variety stores—in cans and tubes.



FENCE PREVENTS DAMAGE IF TRAIN JUMPS TRACK



MODEL locomotives can be prevented from jumping off the platform in case of derailment by erecting a guard fence as illustrated. Use a drill slightly smaller in diameter than the nails, and make the holes $\frac{3}{4}$ in. from the edge of the platform at about 20-in. intervals. Paint the "posts" brown and hang signs between the wire for a finishing touch, if desired.—WILLIAM ANGERMAN.

HOW TO CUT TILE PIPE

VITRIFIED pipe, such as sewer pipe, can be cut by the amateur with less danger of its cracking or breaking irregularly if it is stood on end and filled with sand to the point where the cut is to be made. Then mark a line around and start chipping through with a sharp chisel. Use light blows until the chisel has cut through the glazed surface, after which harder blows with the hammer may be used.—JAMES E. POLISSO.

PAINT FOR SPOTLIGHT

AMATEURS who construct spotlights, either for photographic or stage purposes, often make the mistake of finishing the inside of the tube with aluminum paint. This greatly reduces the efficiency of the spotlight and is also likely to cause rapid deterioration of the bulb because of overheating.

The light passing through the lens should come from a single source because reflected light causes a beam of uneven intensity. Therefore, a dead-black, heatproof paint is used to minimize reflection. It can be made by mixing a tablespoon of coach black paste, obtainable at any large paint store, with turpentine.—GEORGE BEREZOV.

LIST OF MATERIALS FOR A CANTERBURY

(Described on page 72)

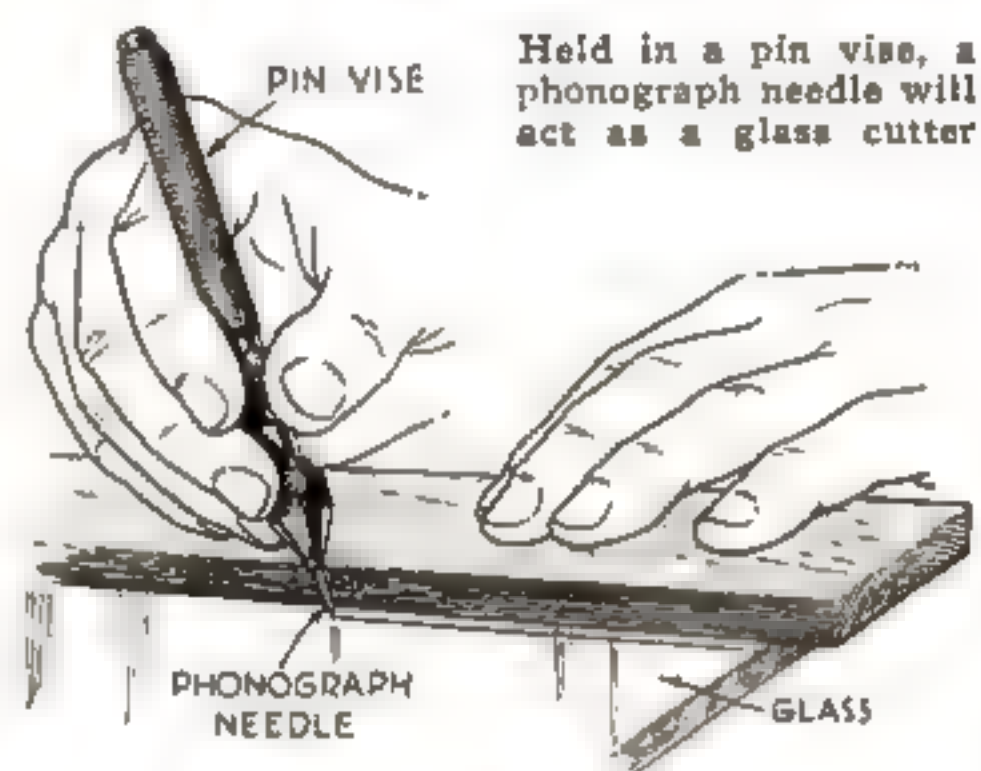
Mk No.	Description	Size*
1 2	Crossbar	$\frac{3}{4}$ x 1 x 14 $\frac{1}{4}$ †
2 2	"	$\frac{3}{4}$ x 1 x 15†
3 1	Handle	$\frac{3}{4}$ x 3 $\frac{1}{2}$ x 15
4 2	Side bar	$\frac{3}{4}$ x 1 $\frac{1}{4}$ x 11
5 6	Vert. slat	$\frac{3}{8}$ x $\frac{3}{4}$ x 8 $\frac{3}{4}$
6 4	Front slat	$\frac{3}{8}$ x $\frac{3}{4}$ x 7 $\frac{3}{4}$ †
7 8	Lattice slat	$\frac{3}{8}$ x $\frac{3}{4}$ x 8 $\frac{3}{4}$ †
7-a	Spacers	1 square
8 2	Upper stretcher	13/16 x 1 $\frac{1}{8}$ x 11
9 2	Lower stretcher	13/16 x 1 $\frac{1}{8}$ x 11
10 1	Base	13/16 x 13 $\frac{1}{4}$ x 14 $\frac{1}{4}$
11 1	Back stretcher	13/16 x 1 $\frac{1}{8}$ x 14 $\frac{1}{4}$
12 1	Back panel	$\frac{3}{4}$ x 4 x 15
13 2	Side	$\frac{3}{4}$ x 4 x 11 $\frac{1}{4}$
14 1	Drawer front	13/16 x 3 9/16 x 14 3/16
15 1	" back	$\frac{1}{2}$ x 3 9/16 x 13 11/16
16 2	" sides	$\frac{1}{2}$ x 3 9/16 x 11 $\frac{3}{8}$
17 1	" bottom	$\frac{1}{4}$ x 11 $\frac{3}{4}$ x 13 $\frac{3}{8}$
18 2	" guide	9/16 sq. x 11
19 1	Front stretcher	13/16 x 1 $\frac{1}{8}$ x 14 $\frac{1}{4}$
20 4	Corner posts	1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ x 18 $\frac{3}{8}$
21 4	Swivel casters	
22 2	Bronze knobs	About 1 in. dia.

* All dimensions are given in inches and are finished sizes.
† Length is approximate; cut to fit.
‡ Curved.

JUNE JOBS Well Worth Doing

EVERY month finds new jobs for the amateur craftsman to do around the house and garden. Here are nine home improvement hints for June:

Install a milk or package receiver.
Build screens for the open porch.
Point cracks in chimney masonry.
Install electric light in garage.
Replace broken window panes and re-putty old windows where necessary.
Lay new floor covering in kitchen.
Waterproof basement walls on inside to help prevent leaks.
Build shoe racks, linen shelves, storage drawers, and other modern fittings in closets.
Modernize house by applying shingles, brick facing, or stucco over present exterior.

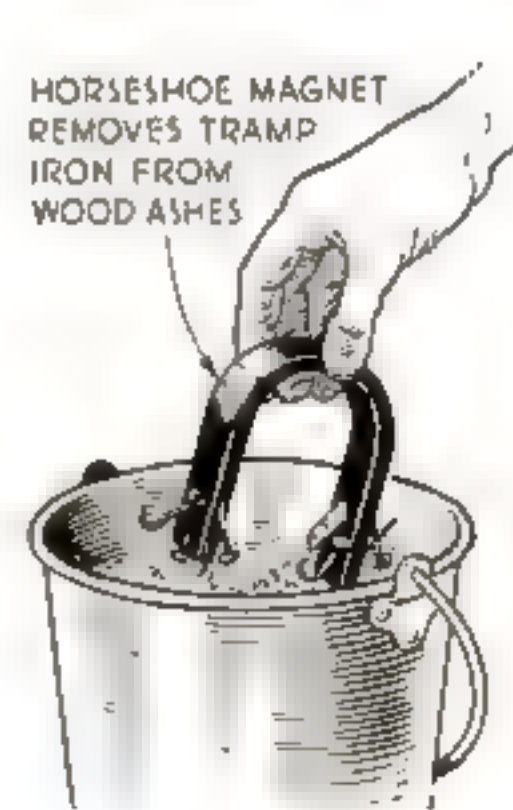


Held in a pin vise, a phonograph needle will act as a glass cutter

GLASS IS CUT BY USING PHONOGRAPH NEEDLE

You can use a phonograph needle to cut sheet glass. It is best to hold the needle in a pin vise while making the stroke. Although the point quickly wears off, the ease with which the needles can be obtained counteracts this undesirable feature.—R. W.

MAGNET REMOVES NAILS FROM WOOD ASHES



Wood ashes from the fireplace are often saved for use as a fertilizer on flower beds. If scrap lumber has been burned, many nails and other "tramp" iron are usually mixed in, but these can be removed merely by passing a large, strong permanent magnet through the ashes. This is much easier than picking them out by hand.

RUBBER CEMENT KEEPS DUST OUT OF FRAMED PICTURES

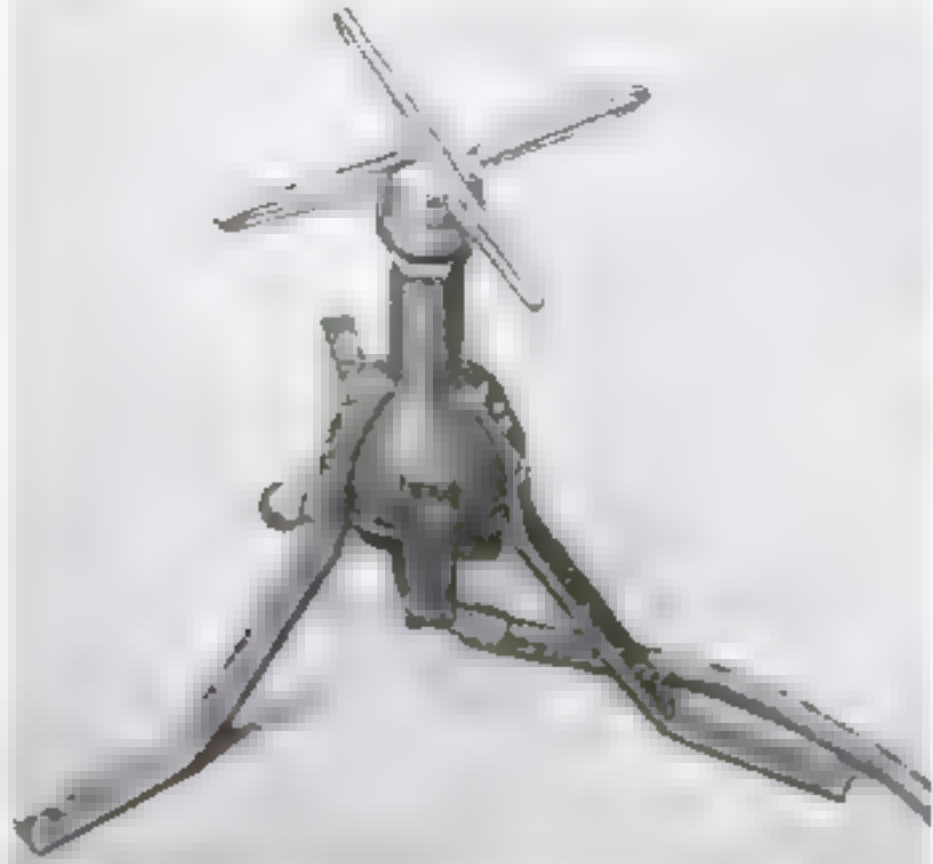
VALUABLE pictures and documents can be made dustproof when framed by applying a thin coat of rubber cement in the corner of the glass rabbet and a similar coat on the edge of the glass before placing it in the rabbet. It is, of course, also necessary to glue a sheet of wrapping paper over the entire back of the frame in the usual way.—CARLETON REED.

GAS STOVE FOR BENCH

(Continued from page 76)

doubled back, and pressed down through holes in the top of the cap. The other wire goes across the top, and the ends are doubled back and inserted in holes in the sides of the cap.

For heating soldering irons, the burner shown in the drawing is very useful. One end of the tee is plugged, and a short length of pipe, with wire arms for supporting the sol-



General utility burner made from a pipe cap

dering irons, is screwed in the other end of the tee. The outer end of this pipe is screwed into a pipe cap, which is fastened to a piece of strap iron bent to form legs. For heating other objects, two holes are drilled in the top of the tee to take a rectangular wire grate. For average use, four 3/32-in. holes should be drilled in each side of the tee at the top. An alternate way is to cut slots in the tee with a hack saw as shown in the close-up view.

The long burner shown is useful for heating rods and similar work. It is made from a piece of 1/2-in. pipe with 3/32-in. holes drilled along the top, 3/8 in. apart. The guard is a single piece of wire passed through holes in the pipe at one end and bent as shown, with the ends pressed into holes at the other end of the pipe.—MERLE TERRILL.

CHAIR MADE OF WILLOW

(Continued from page 76)

beginning at upper back crossbar. Nail other ends to A. Also nail each strip to the preceding one at intervals, and alternate spacing of nails in adjoining strips.

Back. Nail the well-soaked strips for the fan-shaped back filling to crossbars E and F. Nail the first of the 66-in. reeds G at extreme back of seat (at side, of course). Spread the back filling pieces to form a fan and nail through the first 66-in. reed into their ends as indicated. Then follow with the other four reeds. Use enough nails to secure well, but not so many that the wood is split.

List of Willow Branches

No.	Pc.	Dia.	Length	For
2	2	14		Front legs
2	2	28		Back legs
10	1 1/2	16 1/2		Split pieces for seat
2	1 1/2	24 1/2		Front spreaders (leave these longer and cut after assembly)
6	1 1/2	17		Diagonal bracing
8	1 1/2	14		Crossbars
2	1 1/2	6		Front uprights
5	3/4	42		Arms
7	3/4	18		Fan-shaped back filling
5	3/4	66		Back

NOTE. Diameter and length are given in inches.

Swift Death in the Sulu Darkness



Noted Explorer Saves Sleeping Companion in Grass Hut at Laum Secubun

"It's so dark it seems almost sticky just before the dawn comes up over the Sulu Sea," writes Lawrence T. K. Griswold, noted explorer and leader of the famous Griswold-Harkness Expedition into China.

"I woke in this pitchy blackness, raring up off my sleeping mat, wet with premonitory perspiration, shaking with dread of something I could not see or hear or name. I fumbled for my flashlight, snapped it on.

"At first blink it showed me a king Cobra, his hood in full bloom, his head weaving for the strike, that flashing sidewise arc that would mean the doom of my sleeping companion whose head was but a scant 18 inches from the snake! With the light glaring full in his eyes, the Cobra stopped his ghastly weaving, looked fixedly at the light. Getting

carefully to my knees I moved the light so that the Cobra, in following it, turned away from the man on the floor. Cautiously, I stole within reach of my big army automatic, and cut the gun wide open!

"In a split second the place was filled with roars, smoke and riot. My friend was trying to claw through the thatched roof... but Mr. Cobra was hardly fit for a souvenir... thanks to fresh DATED 'Eveready' batteries, batteries that retained their power down here under the Southern Cross because they were really fresh when we outfitted in New York months before. (Signed)

Lawrence T. K. Griswold

"EVEREADY" BATTERIES ARE FRESH BATTERIES

The Date-Line Guarantees Freshness

NATIONAL CARBON CO., INC., 30 East 42nd St., New York, N. Y.



THESE "EVEREADY" ADVERTISEMENTS ARE VERY INTERESTING, MR. DANIELS; BUT I STILL DON'T SEE WHY THE DATE-LINE MAKES A BATTERY BETTER

WELL, MR. BROWN, A FLASHLIGHT BATTERY COULD STAND ON MY SHELF TWO OR THREE YEARS AND LOOK NEW... BUT IT WOULDN'T LAST LONG. MOST OF THE MOISTURE THAT MAKES IT WORK WOULD BE GONE



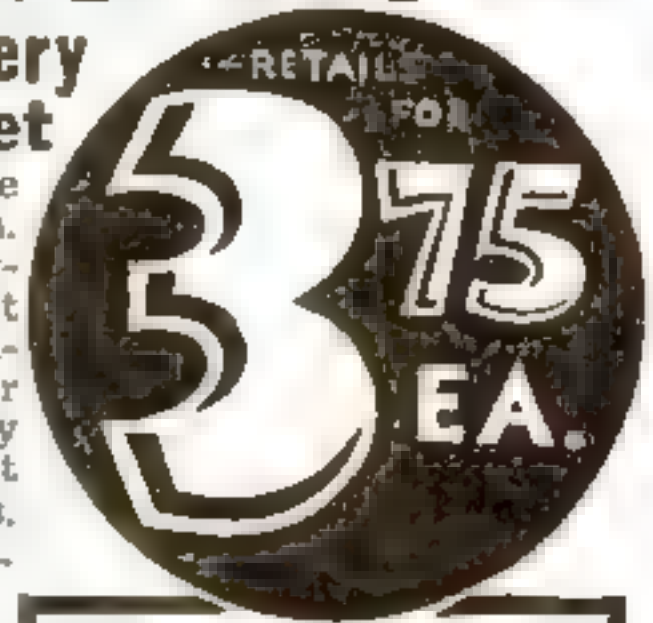
New 6-Volt TRINDL Electric ARC WELDER...

Works Off Any Storage Battery Or Ordinary Light Socket

This new electric arc welder is made possible by the invention of a low voltage carbon. Auto batteries may be used without removing from car. Uses about the same current as four headlight bulbs. Can be used on electric light socket by using a Trindl converter in place of battery. Broken parts are simply melted together by the white hot electric arc, in just a few seconds. Produces about 7,000 degrees heat.

HOTTEST FLAME KNOWN

Melts iron and steel instantly. Welds fender, radiators, holes in bodies, milk cans, tanks, brazes broken castings. Works on anything—iron, steel, brass, copper, tin or galvanized metal. Permanent repairs made almost for nothing. Used by factories in many operations. Positive money-back guarantee by a responsible firm. Act now!



AGENTS Men with cars to sell mechanics, repairmen, farmers, radio and battery shops, factories. Five-minute demonstration makes sales UP TO 150 PROFITS! Write Today!

TRINDL PRODUCTS, 2229-MHCALUMET AVE., CHICAGO, ILLINOIS



Shaves are Kinder to Your Face

when razor and blade match

FOR clean, comfortable shaves, men everywhere agree that this perfectly matched shaving combination is tops! And no wonder! Where will you find shaving comfort to compare with the results you get from the flawless teamwork of the Gillette Razor and the Gillette Blade?

It is because this razor and blade are made for each other that they work so smoothly together. It is because they are designed as a unit—produced in the same factory—that they give a measure of shaving comfort that can't be beaten.

Diamonds Test Hardness

At the Gillette plant no expense is spared to assure users of Gillette Blades the utmost in shaving satisfaction. For example, real diamonds—80 times harder than any other known substance—are used to test the temper of Gillette steel. Variations of as little as one and one-half percent from desired hardness results in immediate rejection of the metal!

So why experiment when you know that the Gillette Blade is the ideal teammate for your Gillette Razor? Buy a package today. Use one in your Gillette Razor tomorrow morning and enjoy a wonderful new kind of shaving thrill!

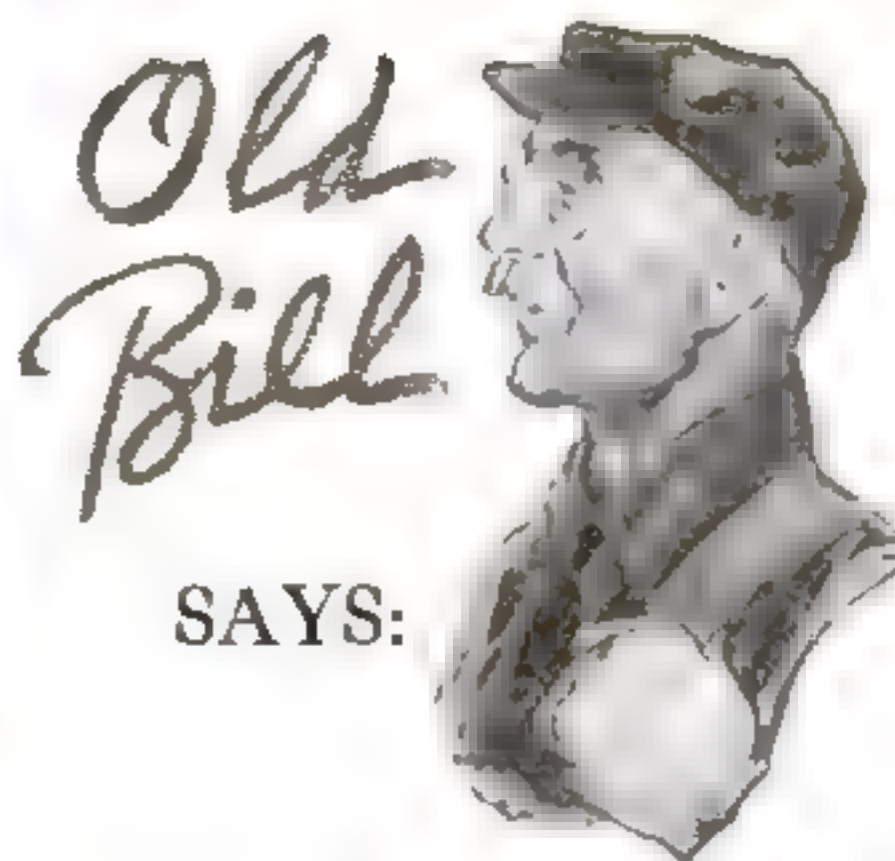
Reputable merchants never offer substitutes for Gillette Blades. Always ask for them by name!

Smile and sing with Milton Berle and other stars on Gillette's "Original Community Sing" radio program—CBS Network—Coast to Coast—Every Sunday night.



Gillette Blades

Precision-made for the Gillette Razor



BEFORE making a punch and die for a new job, look into the condition of the press. If the ram is substantially worn, best results will be obtained if the guide posts are fitted to the punch holder rather than the die shoe.

By using the tool-post grinder and a small wheel, you can easily concave the top surface of a forming or threading tool to within 1/64 in. of the cutting edges. You can thus increase the feed and improve the finish and even the accuracy of the work.

The work section of mandrels to be used for bores exceeding 4 in. in length should be ground two thirds straight and then plus .001 in. increasing to .002 in. on the remaining drive section. This is a common-sense idea that will save the mandrel itself and the arbor press. It will also prevent distortion of work.

When making plug gauges of substantial diameters, counterbore the ends 1/4 to 1/2 in. deep and one half the diameters of the tools. The excess wear is always on the ends, which can be easily ground off without affecting the center holes.

A periodical application of neat's-foot oil to leather belting will prolong its life.

Don't take advantage of a milling machine because you've been handed what looks like a soft job. In many cases, a roughing cut in the shaper will reduce the initial cost of the tool. The cost of the average forming tool, for example, can be substantially reduced by first removing all excess stock in the shaper.

Ring gauges can economically be made in two parts—cheap steel bodies with high-speed inserts. Two or three of the inserts can be made at one time and kept on hand for replacements. However, the lapping operation should be done after assembling.

Shop made gauges, if not subjected to at least an artificial seasoning treatment before finishing, are of little value. Grind the sizing dimensions to plus .002 in. and dip the parts in boiling water for one minute, then in ice water for the same length of time, and repeat from fifteen to twenty times. The gauges may then be finish-ground and lapped.

Don't brag that your experience will make your job secure, but keep right on plugging. Remember that our modern machine tools have the next thing to mechanical brains, eyes, and hands.

There are many assembling jobs of all descriptions where the cost of threading holes can be avoided by using so-called "self-threading" or "self-tapping" screws and bolts. You needn't worry, they stay put!

PREPARING THE SPARS FOR OUR BRIG MODEL

(Continued from page 86)

lowermasts and bowsprit, white. Other spars are white where they are double, and a natural pitch-pine color elsewhere. Yards may be black or white. Booms are white at ends, and natural between.

Tops. Trestletrees and crossrees are half-lapped to give a flat upper surface on which to fasten the thin wood platform. The middle space inclosed by the four supporting members is such as to form a tight fit on the squared head of the lowermast. A lubber hole is cut in the platform. Through the outer edges drill three holes on each side for futtock-shroud bars. Drill holes through after end of main trestletrees, fasten an eye in the middle underneath, and an eye abaft the foremast for the main topmast stay. Topmast crossrees are similar, but not boarded in, and the forward crossree is cut curved to meet the second. In the crossree ends are holes for the topgallant shrouds.

Caps. Fiber board is excellent, but celluloid or hardwood will do. Cut the holes at an angle so caps will rest horizontally on the sloping masts. The after holes fit tightly on the squared mastheads; the round holes, loosely on the other masts. The space between the masts must be such that the masts are parallel where they are double. Drill holes in lower caps at the sides, and an additional hole abaft in the cap for the mainmast. The bowsprit cap is similar but a trifle heavier; it has a hole underneath, and eyebolts on top for the staysail netting.

Deadeyes for lower rigging and topmast backstays are 3/16 in. A chain plate to hold a deadeye down to the channel is made by flattening a piece of No. 20 wire. Bend the top end over to form a little hook, and into this solder a double ring of No. 30 wire. The latter should be of such a size that when it is squeezed together under the deadeye and set down tightly in the channel slot, the hook will be close underneath. (A ring 1/4 in. in diameter should be correct.) Flatten the lower end of the chain plate still more and drill for two 1/2-in. pins. Take care that all holes will be in line on the hull.

Topgallant deadeyes are 1/8 in., similarly fastened.

Futtock-shroud deadeyes are 1/8 in. Place top on its mast; around one deadeye pass a piece of No. 26 wire and twist underneath; pass it through the hole in the top and through the eye in the mast, twisting it again. Repeat until all deadeyes are in place. Get deadeyes tightly down on the tops. Be careful to see that the tops lie horizontal, athwart and fore-and-aft, when each of the masts is stepped.

(TO BE CONCLUDED)

HOW TO FASTEN AN ELECTRIC WIRE HEATING ELEMENT

WHEN repairing the heating element of a flatiron or any appliance with a special heating wire, do not wind the wire around the screw, as the wire is likely to cut itself that way. Instead, make a U-bend, fasten it under the screw head, and turn the screw down tight.—MILDRED E. HICKMAN.

CELLULOSE MENDING TAPE MAKES GROUND GLASS TRANSPARENT

IN ORDER to make a clear spot or strip for looking through a piece of ground glass or a smoothly frosted window, it is necessary merely to stick on the glass a piece of transparent cellulose mending tape of the type sold at stationery stores. Wherever it is covered with the tape, the ground glass appears transparent.—J. E. P.

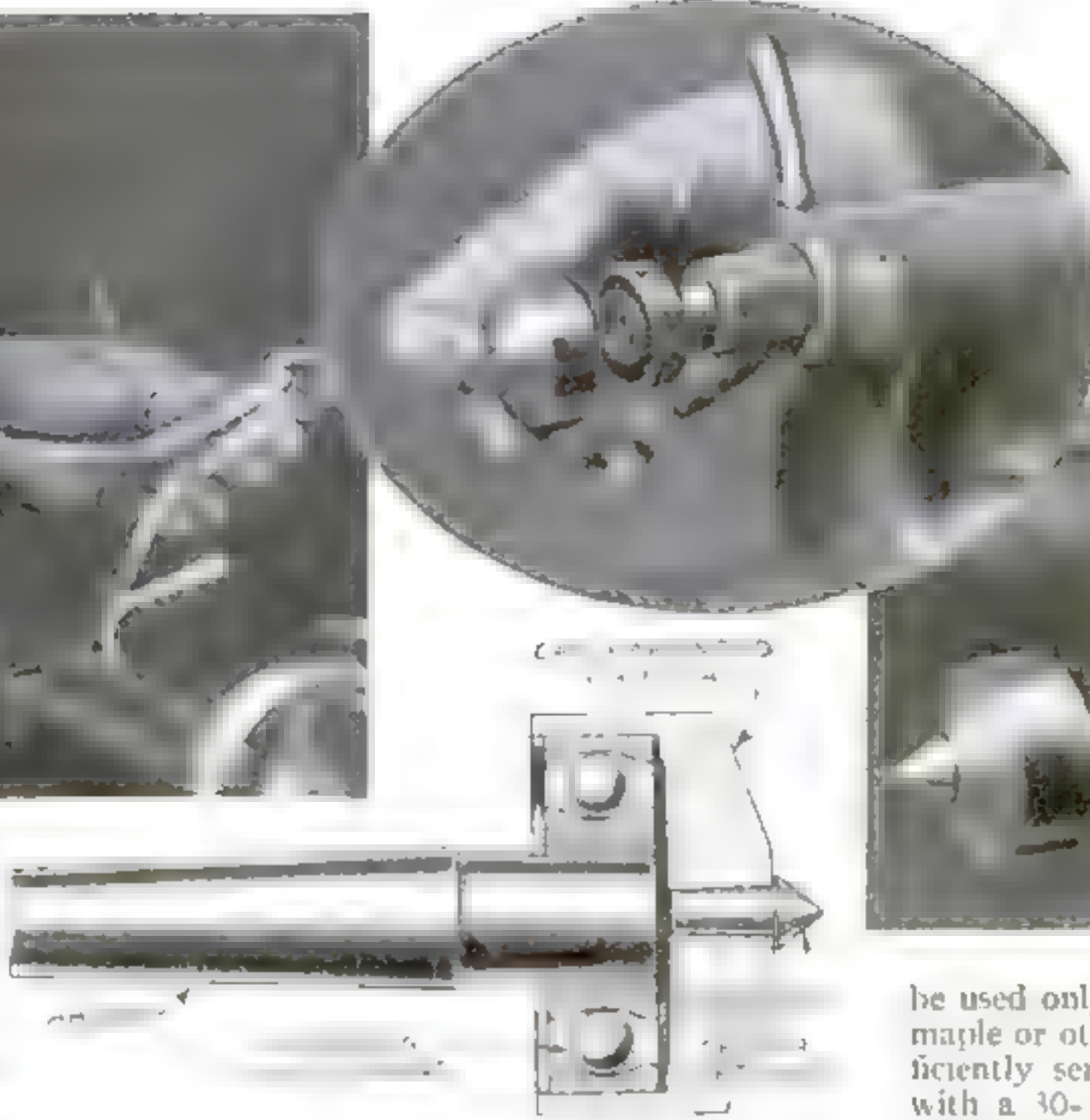
Ball-Bearing Live Center for Lathe



Using the frictionless live center to support the free end of a piece of pipe while being turned. The center is made as at the right

NOTHING more than an automobile-generator ball bearing fitted over a tapered arbor is required to make a practical, frictionless live center for either a metal or a woodworking lathe.

As constructed with a removable center with a flat face, it can be used for holding work in metal spinning or for supporting awkwardly shaped pieces in the chuck while turning. The tapered nose adapts the live center for turning, polishing, and burnishing pipe or tubing as illustrated in the photograph at the left above. When grinding or buffing on wheels provided with a Morse taper in the headstock, this live center will



prevent the slipping or accidental loosening of the grinding-wheel arbor. The home craftsman will find many uses for this attachment in his workshop.

To make the live center place the arbor in the headstock and turn the end to the proper size to afford a forced fit with the center of the ball bearing. Turn a cap, as illustrated, from cold-rolled steel; or if the center is to

After the ball bearing has been mounted on an arbor, a cap is turned and slipped over it as shown at the left. The complete live center, with a removable spur center inserted, appears below. It is indispensable for turning pipe



be used only for woodworking, a cap of maple or other hardwood will prove sufficiently serviceable. The cap is turned with a 30- or 60-deg. taper, as desired, and slipped over the ball bearing as shown in the oval above.

A removable spur center may be attached by drilling and fitting as indicated in the drawing and the third photograph. If desired, the cap can be turned to a forced fit over the ball bearing and made deep enough to permit a washer to be fitted over the rear of the bearing to inclose the ball race and keep it free from dust.—W. WALDEMAR.



WAR DECLARED ON UNSAFE TIRES

War Dispatch By
EDDIE RICKENBACKER
Ace of War Aces

FROM my "reserved seat" in the sky amid the thunder of anti-aircraft guns, I have seen our boys mowed down on shell-torn battle fields like blades of grass. Yes, I thought that in those hectic years of strife the loss of American life had reached an all-time high.

But I was wrong. In 1936 nearly 38,000 American motorists were killed in accidents. Included in this appalling total are thousands of motorists who are killed or injured every year when blow-outs throw cars out of control—thousands upon thousands of car owners who do not seem to realize that one great factor in *safe* motoring is *safe* tires.

EDDIE RICKENBACKER

Goodrich has mobilized an army of

36,000 Goodrich dealers whose main objective is to replace unsafe, tread-worn tires with new, safe, full-treaded tires—tires that provide motorists with real protection against high-speed blow-outs.

Their ammunition is the Goodrich Safety Silvertown—the *only* tire built with the Life-Saver Golden Ply. This is a layer of special rubber and full-floating cords, scientifically treated to resist the terrific blowout-causing heat generated *inside* all tires by today's high speeds. By resisting this heat, the Golden Ply prevents the great, unseen cause of high-speed blow-outs.



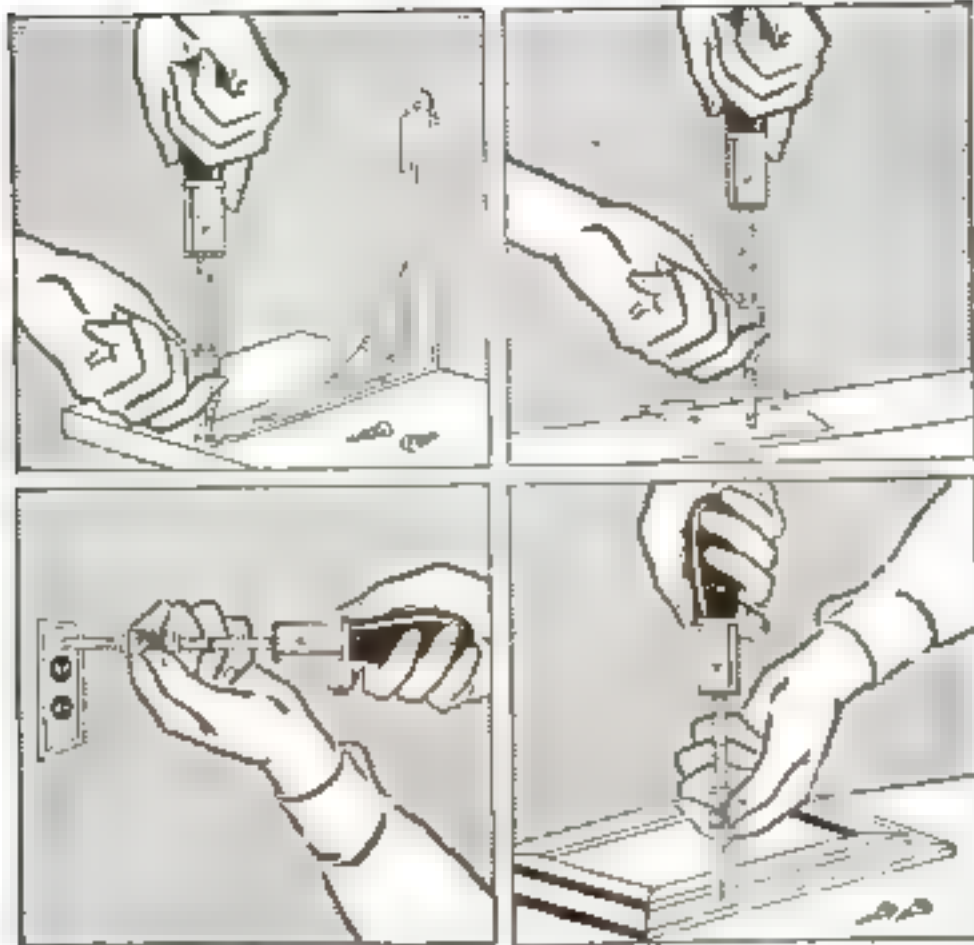
Keep off the 1937 casualty list. Join the "safety first" army by starting to ride on Goodrich Golden Ply Silvertowns *today*. Remember, these life-saving tires that also give you months of extra trouble-free mileage actually cost *much less* than other super-quality tires.



Goodrich SAFETY Silvertown

With Life-Saver Golden Ply Blow-Out Protection

JUST PUSH—



"YANKEE" Handyman



You have always needed a "Yankee" Spiral Ratchet Screw-Driver for work around the home. Now, for the first time in history, you can buy a genuine "Yankee" for \$1.00!

AMAZING VALUE! The new "Handyman" size — for shop, home, garage. "Yankee" Quality! Same as the famous "Yankee" Tools that add skill, speed, save labor and help "Make Better Mechanics."

See it on display at your dealer's. "Yankee" No. 33 H. Price, \$1.00. For boring small holes for screws or other purposes, buy also "Yankee" Chuck and 3 Drills. They fit Driver in place of blade. Price, 39¢ for "Yankee" Drill Set, as shown below.

"Yankee" Chuck

"Yankee" Drill $\frac{1}{8}$ "

"Yankee" Drill $\frac{1}{16}$ "

"Yankee" Drill $\frac{1}{32}$ "

---COUPON---
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HOW TO PAINT CONCRETE FLOORS SUCCESSFULLY

(Continued from page 77)

part cement to 2 parts washed "brick" sand such as masons use to point up brickwork. Sand containing dirt is useless for cement work and must be avoided.

Next, the grease or oil must be removed with a strong lye solution and a broom. Cleaning gasoline may be used instead if there is no fire in the basement and caution is exercised, or a combination of gasoline and denatured alcohol. This must be completely washed up and mopped clean.

The entire floor should next be well scrubbed with a broom or floor machine and a trisodium-phosphate washing powder. Do not use soap or soap powders, or a film will be



A weighted piece of linoleum or rubber is used to test for moisture before painting

left on the face of the floor to which paint will not adhere.

Following the trisodium phosphate scrubbing, the entire area should be well mopped with clean water, which should be changed frequently. Give sufficient drying time as for new floors, and use the same test for final condition. Then apply a well brushed out aluminum and varnish primer.

Power-station engineers have found the latter especially valuable as a ground trap for stray electrical currents, which often produce a condition of electrolysis, or spot softening of the concrete, in the presence of moisture.

Enamel coats applied over the primer will give a floor surface which will remain hard, clean, and smooth for years to come, while permitting easy cleaning throughout. For most coatings of this type, it is safe to figure 100 sq. ft. per gallon on an unprimed floor for one coat, and 200 sq. ft. for two coats.

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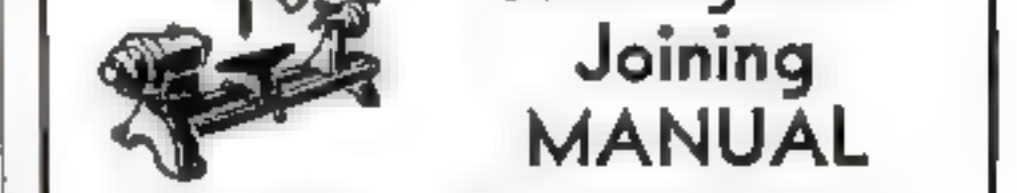
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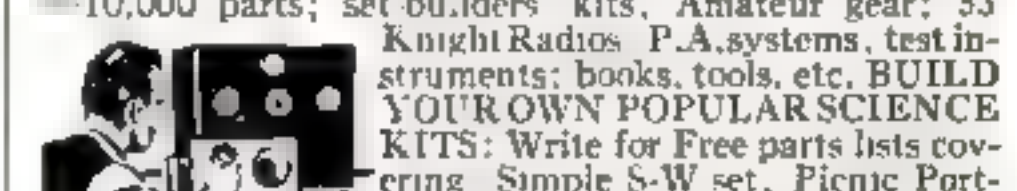


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Some Handy Tricks in Camping Out Told by an Expert Guide

flames and smoke. Of course, the fire should be built at least ten feet from the nearest tree, away from dry grass and underbrush, and to leeward of the tent.

It is surprising how well you can get along without any cooking utensils except a Dutch oven for boiling, baking, and dish-washing; a tin can in which to boil water and coffee; and a skillet.

You need no experience to broil succulent fish, fowl, or steak; to bake meats of various kinds, or to bake bread, without any utensils at all. All you require is a stick, a rock, and a few pounds of clay.

TO COOK a fish of moderate size, for instance, first clean it in the usual way, leaving both head and tail intact. Meanwhile, have available a stick about thirty inches long, curved at one end like a fishhook, the other end cut to a sharp point. Stick the pointed end through the mouth, run it through the flesh under the backbone, and carry it on through the tail. Draw the entire length through the fish until the curve fits alongside the jaw. Thus you can turn the fish over and over above the hot coals until it browns on all sides. When the flesh becomes soft, the well-done trout or bass will slide down the stick and drop onto a plate easily. The same method serves for cooking fowl or steaks. Make sure the stick is green, or it will burn.

You may prefer the rock method. Place a flat rock on a deep bed of coals, banking it around the edges with ashes to heat it rapidly. Test it for temperature as you would a skillet. When it is hot, fry or broil meat on the rock as you would at home. Remember, though, that some rocks disintegrate when heated. It is a good plan, therefore, to test your rock before using it, just to make sure.

(Continued from page 47)

Delicious double-crusted pies may be baked easily in a similar manner, excepting that heat must be applied from both top and bottom. Place the pie in an iron pan, and cover it with a close-fitting iron lid. After settling the pan in hot coals, pile hot ashes and coals on the lid. The cooking time depends on the size of the pie, thickness of the pan, and the fire.

Fowl, from quail to geese, may be baked in clay. Make sure the coating is at least two inches thick, to prevent burning. Bury the package under coals and leave it from one to four hours, the time depending upon the size of the bird, thickness of the clay covering, and heat of the coals. With experience, you can bake birds as skillfully as at home.

Not all your time will be spent around camp. You will plan hikes of a few miles at a time. In some sections, storms come up suddenly and might make it impossible for you to regain camp. For that reason, carry a canteen of water and some food, such as chocolate and raisins, everywhere you go. Also, a length of strong cord, a piece of soft, pliable wire eighteen inches long, a small ax, carried on the belt, a hunting knife with a five-inch, broad-backed blade, waterproof matches, and a candle should be part of your equipment. In strange country, carry a compass and have topographical maps available.

All these things are important. If you become lost, do not fret but seek cover and take stock of your situation. Make a temporary camp in a cave, under a large tree, in a hollow tree, or under a rock. If you have a can, punch two holes near the top and hook the ends of the wire in them, and you have a pot for boiling water.

The matches, which are easily waterproofed at home by dipping the ends in melted paraf-

fin, and the candle guarantee fire and warmth. After gathering wood, place the candle under the pile in a sheltered position and light it. When the wood ignites, remove the candle.

Most storms last only a few hours, after which you can return to camp. Should you think you are lost, wait until the sky clears and you probably will recognize landmarks that will guide you back to your destination.

In planning hiking trips, either from camp or as your entire vacation, be guided by your physical abilities and not by your ambitions. Four days and three nights are long enough to be out on the trail, unless you know from experience that you can withstand the hardships for a longer period.

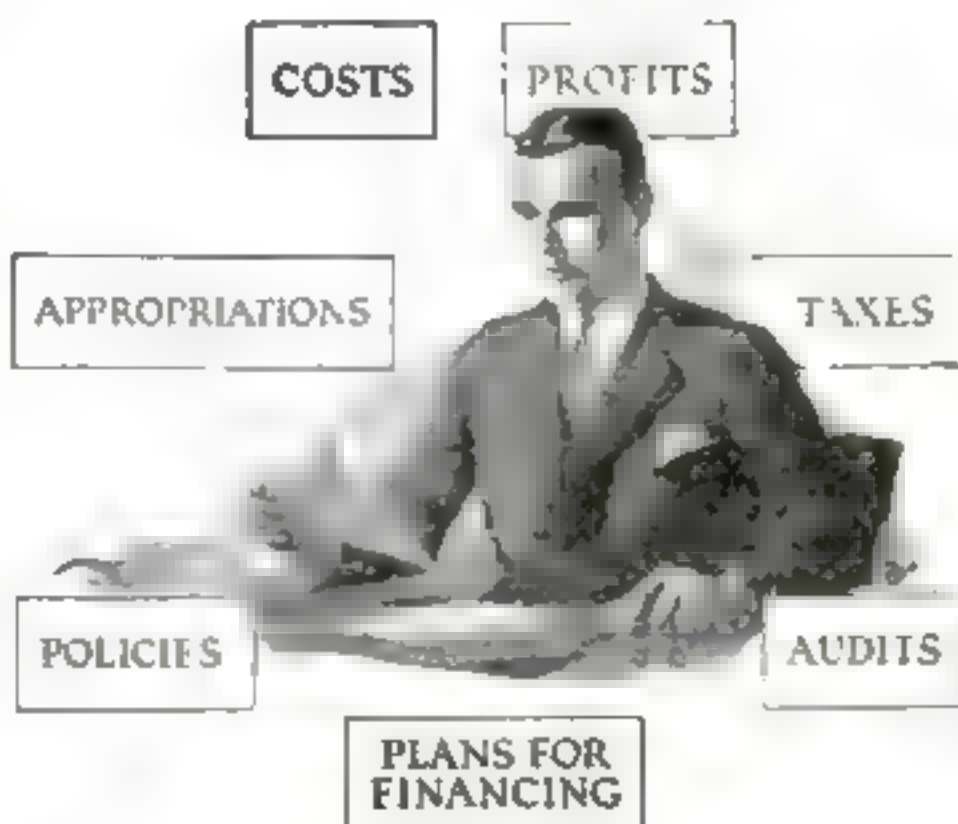
AROUND a permanent camp you require only light clothing in most climates, but for hikes in snake country, be sure to wear leather boots fourteen to sixteen inches high, or ten-inch boots if the trails are snake-free. I prefer composition soles, for both leather and hobnails slip on wet rock. Wear long woolen socks, with silk socks underneath. In the mountains, where sudden temperature changes may be encountered, wear long, light, woolen underwear, a wool shirt and some garment to break the wind, such as a leather jacket. An extra pair of socks is advisable. In case of rain, seek a dry spot, remove all clothing, wring it out as dry as possible, and dress immediately. Wool dries rapidly on the body, and you run less chance of catching cold in damp clothing than when unprotected against wind or water.

Do not attempt to carry more than forty pounds in your pack. Thirty pounds is an average load that is easily carried. I recommend a light pack rack, weighing about one pound, made of durable wood, with cross

(Continued on page 108)

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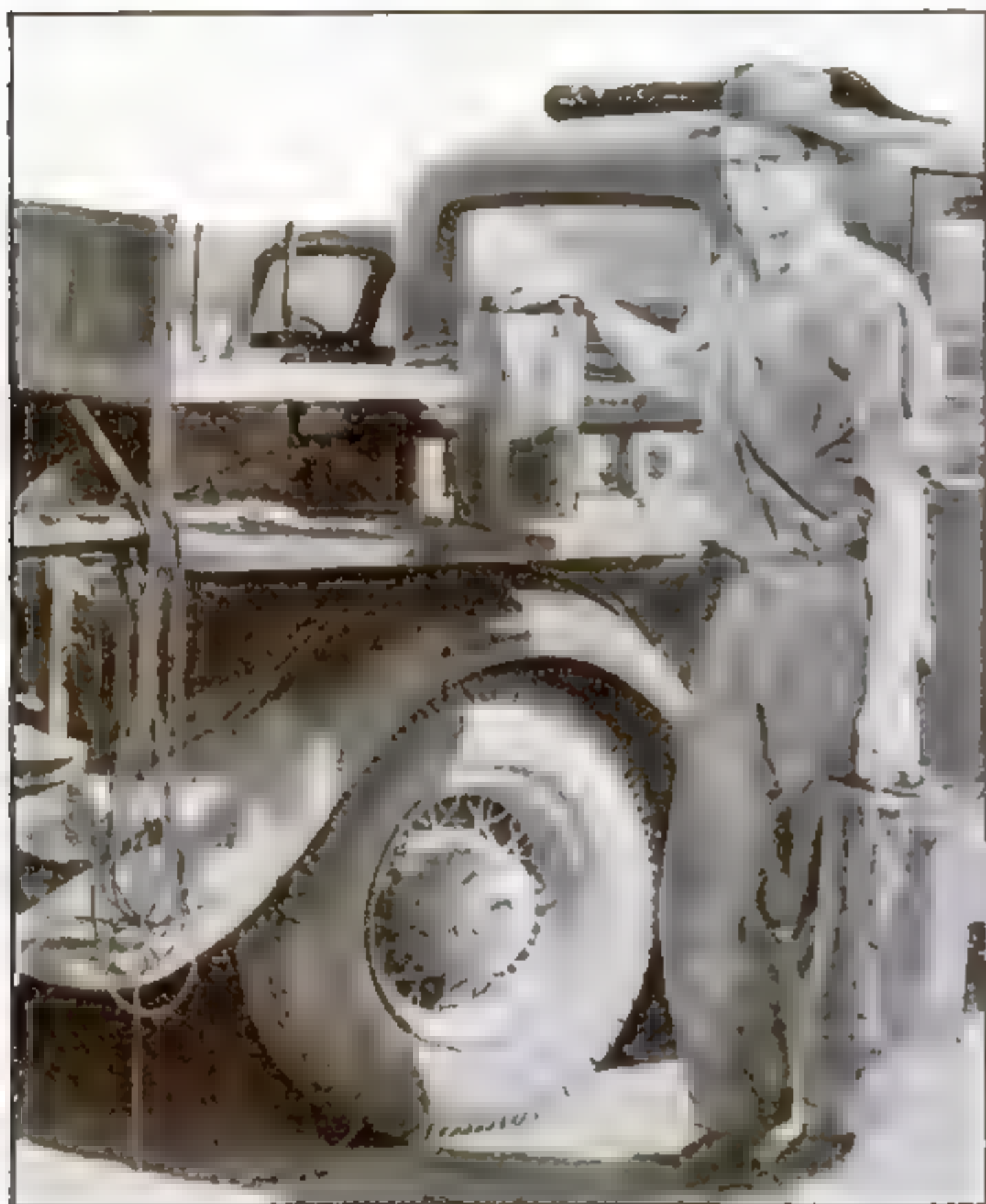
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TRICKS IN CAMPING OUT

(Continued from page 107)

straps that provide a cooling air space between the load and your back.

In packing, roll all hard objects inside your blanket, preferably in a canvas bag. Place this near the top of the pack, for the load rides more easily if it is slightly top-heavy.

You should count on two pounds of food for each day of camping, except on hiking trips, when dehydrated fruits and vegetables will cut this weight by half. In addition to bacon, coffee or cocoa, dehydrated eggs (good when scrambled), sugar and corn meal or flour, carry two cans of soup, fruit, or fruit juice for each day you expect to be gone. Here is where an eighteen-inch wire comes in handy.

OPEN two cans for dinner in the evening, fit the wire into holes, and you have excellent pots for heating soup and boiling water. Throw them away after breakfast, but save the wire. You can buy tinned butter that will remain fresh a few days after opening. Bacon should be already sliced, and is useful in providing grease for frying fish. Dehydrated fruits must be soaked overnight, whereas vegetables only need to be mixed with water and heated. Don't forget to take a can opener.

On trips of this sort, it is better to take a warm drink than to eat heavily when reaching a camp spot weary and hungry. Bouillon is refreshing, and even warm water alone is invigorating.

Beware of colds, blisters, and cuts while in the open. The first may lead to pneumonia, the second to blood poisoning, and the latter are a nuisance, to say the least. To avoid later troubles, carry as complete a first-aid kit as possible. This should include a piece of heavy cloth about eighteen inches square, for use as a head bandage or arm sling; one dram of sodium permanganate; two ounces of sodium bicarbonate; twelve cathartic pills; two gauze bandages two and a half inches wide, and two cotton bandages three inches wide; one roll of adhesive tape, one inch wide; twelve safety pins; a little absorbent cotton; one ounce of tincture of iodine, and one yard of sterile gauze.

Clear white gasoline, soap, talc, and flowers of sulphur mixed with cornstarch also are useful. If, in the vicinity of poison oak or poison ivy, you feel an itchy sensation, soak a rag in gasoline and apply to all exposed parts. Avoid water. Repeat in two hours, and again twenty-four hours later if the itching continues. Flowers of sulphur rubbed on the skin will prevent "chigger" bites. In hot weather, the cornstarch is used to make the sulphur adhere to moist skin. As for mosquito bites, they may be avoided by wearing netting around face and neck. A heavy petroleum-base grease, while not pleasant, also is effective.

TALC and a good grade of soap are worth their weight in gold when you limp into camp suffering from the pain of a large blister. Work the soap into a rich lather and apply it to the blister. Then sprinkle talc over the soap, finally wrapping the blistered part to keep out dirt. For safety's sake, do no more walking than necessary until the blister heals.

Pack trips, which carry you to virgin country not yet penetrated by highways, should be undertaken only with an experienced guide. Generally, you may safely carry to your point of departure canned goods, with which good meals may be quickly prepared. Nobody enjoys being camp cook, and canned goods today are usually tastier and more wholesome than the average man can prepare.

If you follow these suggestions, your vacation in the open will be more likely to prove inexpensive, comfortable, and productive of dividends in health and pleasure.

Make Lifelike Portraits of Your Friends by 'Camera Sculpture'

and hole screen are fastened properly in position, and the bulbs are screwed into place, you are ready to adjust the shadows for photographing a subject.

To do this, take a light-colored felt hat and support it in the position that a subject's head would occupy. Then turn on the upper lamp alone, and move its bracket until the lines of light projected by the holes upon the hat are at their clearest and brightest. Then tighten the screw to hold the upper lamp arm in position.

Now turn on the two side lamps and adjust their brackets until the shadows cast upon the front and back of the hat are equally sharp and black. Then make sure that every third shadow cast by the wire mesh of the side gratings joins up with one of the bright lines thrown by the rows of holes in the upper screen.

WHEN the lamp arms are correctly adjusted and clamped in place, you are ready for a sitter. He, or she, must be posed with the direct profile toward the camera, which must be on a tripod with the lens opposite the center of the little stage on which the subject's head is being illuminated.

With the subject in position, have him move slightly toward and away from the lens, and watch how the dark and light lines from the side and top screens are contoured upon the face and hair. Note that each line can be traced around, outlining a section through the subject's head, just as the knife cuts outlined the sections of the apple.

Note whether the shadows of the wires are visible on all parts of the face and neck. They should be visible under the chin, the cheek and ear, and into the eye socket. If they are not, readjust the lamp arms until

(Continued from page 61)

they are, and then match up the lines upon the light felt hat exactly as you did before.

When the lines are clearly visible on all parts of the subject's face, head and neck, you are ready to make an exposure with the camera.

By using super sensitive panchromatic pack or roll film and an F/4.5 lens, with the three 200-watt lamps in the apparatus, you can take exposures of a tenth of a second with people of light complexion and hair. Dark skins and hair will require from a fifth to a half-second.

When your films are developed and found to show the shadow contour lines with distinctness on the face, neck, and hair, you are ready to make an enlargement of the head to the size that you want the finished relief portrait to be. A good size is about six inches high, but they are easier to do life-size.

With the enlargement made, place it upon a drawing board and cover it with thin tracing paper—or, better still, with a piece of architect's tracing cloth. Hold two corners with thumb tacks. Then trace each contour line completely, beginning with the smallest, until you have every section outlined clearly and accurately upon the tracing cloth.

Now and then, you will find that two or even three of the shadow lines join up for a short distance on the face, especially around the nose and mouth. This merely means that the edges of the same sections will coincide for the same distance in the finished model.

After you have finished on tracing cloth a complete outline of every section, as shown in your enlargement, it is a simple matter to transfer the separate outlines to cardboard, using typewriter carbon paper and a hard,

sharp pencil, and cut them all out with a pair of very sharp scissors. You will find it helpful to number the contour lines on the tracing, and to mark the sections with corresponding numbers as soon as they are outlined on cardboard.

PREPARE, as a foundation for your plaque, a circular or oval piece of plywood. It can be of any thickness desired, but should not be too thin, because the finished plaster casts will be of the same thickness and they must not be too fragile.

Then take the largest section of the head and glue it to the center of the plywood base. Build up the other sections, one upon another, gluing each in place as you proceed with the work.

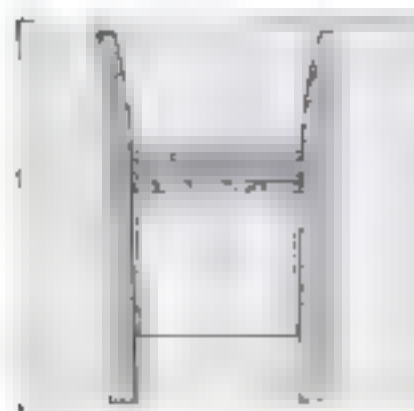
When the last section (the smallest) is in place, you will get your first rough hint of what the complete sculpture will look like.

To finish it, take medium-grade sandpaper and trim down any rough projecting corners on the cardboard "steps." Then take putty or modeling clay and a blunt-ended table knife, and fill up the "steps" of the sections. When you have filled all the angles, so that the surface becomes an even curve instead of a series of steps, you will have a lifelike, low-relief portrait of your sitter, although you may not have a spark of ability to model in clay from life!

If you use putty instead of modeling clay, it will get hard, and the model can, if desired, be painted or enameled. Probably the best method (which also allows of making duplicates) is to cast the plaque in plaster. For this the original model should be shellacked thoroughly. It is then easy to make from it, first a plaster-of-Paris mold, and then a plaster plaque.

LIFE BEGINS AT 25 thousand miles

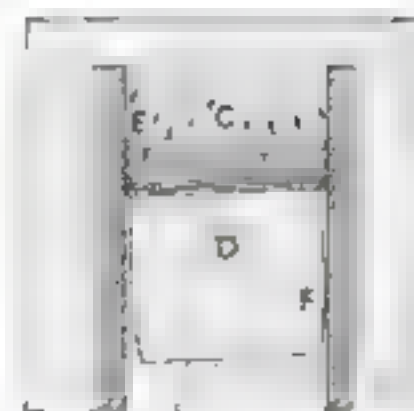
How amazing new Perfect Circle X-90 Piston Ring restores new-car pep and oil mileage — doubles engine life!



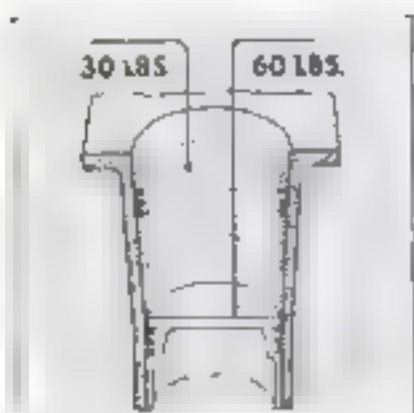
1. After 25,000 to 30,000 miles, the cylinders in a car engine are worn larger at the top than at the bottom. (The diagram, of course, is greatly exaggerated.)



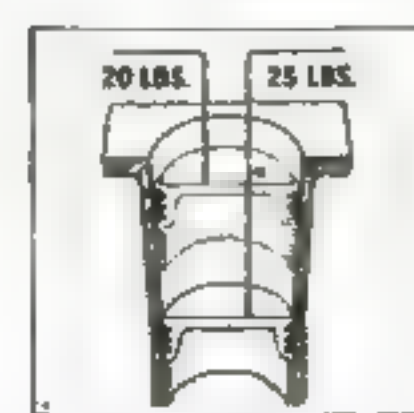
2. Compression is lost (a) and the power delivered to the crankshaft (2) is wasted—car is sluggish. Oil also escapes up past the piston rings when cylinders become worn, causing carbon, and excessive oil consumption.



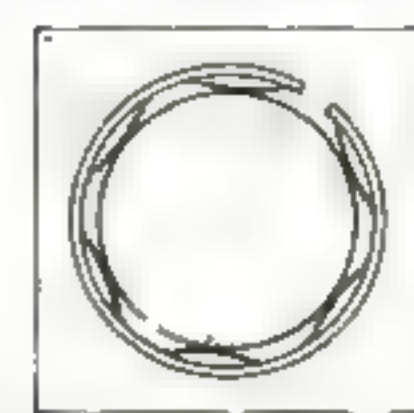
3. Aluminum pistons also collapse, causing piston rock and piston slap and making it impossible for the rings to seal the cylinder walls. P. C. Piston Expanders bring the pistons back to their original shape and fit.



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ENGINEERS TURN DETECTIVES TO SOLVE MYSTERIOUS ACCIDENTS

(Continued from page 21)

formation, jamming the vital control surfaces.

In the other disaster, ten sight-seers started for a night flight over Pittsburgh in a trimotored transport plane. Hardly had the ship cleared the airport, when all three engines cut out at the same time. The machine crashed, telescoping into a tangle of wreckage and carrying all the occupants to death.

Airway experts reached the scene in five minutes and began examining the wreck. In the crumpled cockpit, they found the cause of the accident—the heel of a woman's shoe. One of the women passengers had been sitting on a narrow emergency seat in the cockpit. In bracing herself after the take-off, she evidently had pushed her right foot under the cowl where the heel of her shoe jammed against a small valve lever, cutting off the fuel supply to the engines.

UNDERGROUND blasts—dust, gas, and dynamite explosions in mines—provide ticklish jobs for the expert in search of clues. Specially trained state and Federal officials are on call for investigations of this kind.

Some weeks ago, a mysterious blast in a California mine killed five miners and an engineer. The tragic story of the disaster was relayed immediately to state officials in San Francisco. F. L. Lowell, the mining inspector nearest to the scene of the explosion, was "somewhere in northern California" on a motor trip.

Over the teletype flashed a description of his car, with an order directing him to the mine. At Carquinez bridge, near Oakland, officers caught up with him. Lowell turned his car eastward, sped beyond the Nevada line to find roads clear of snow, doubled back along an open highway, and reached the head of a nine-mile tramroad, the only means of access to the shaft where the explosion had occurred.

Deep in the earth, Lowell studied fragments of the electric wiring. It had been safeguarded properly. This left him only one conclusion: a bump had set off a detonating cap on the powder car and 700 pounds of dynamite had spread death and destruction.

Following another mining disaster, in the coal regions of the East, investigators found an electric flash light, its glass parts shattered. Under a microscope, they studied the ends of the metal filament of the bulb. One piece ended in a tiny ball, the other in a sharp point. This told the scientific detectives much. It indicated that the filament had fused in the open air, following breakage of the protective glass, and thus had ignited the fire damp or combustible gas which forms within such mines.

FROM the high seas, as well as from the air and underground, come problems and mysteries for the engineering sleuth to solve.

In one instance, I was told, a collision in fog was traced to compass errors caused by semipermanent magnetism in the metal hull of the ship. This magnetism, the investigators found, had been built up when the vessel was docked for several weeks in a north-south position. To prevent such difficulties, metal ships under construction have their keels laid down in a northeast-southwest direction, crosswise to the lines of magnetic force in the earth.

A few years ago, a large oil tanker was plowing through heavy swells midway between California and Hawaii. Without warning, a terrific blast rocked the vessel and killed several of the crew. For five days, as the ship raced back toward San Francisco, the remaining members of the crew fought the blaze. With bulging, flame-seared tanks,

the ship passed through the Golden Gate and eased along side a dock.

Gas experts, hull inspectors, engineers, swarmed over her side and down into the tanks. As no one had been below decks at the time of the accident, the explosion could not have been caused by a man-made spark. One thing, which the average person would have overlooked, caught the eye of one of the investigators. This was a number of large rust flakes. By rubbing some along the metal wall of the tank, he produced sparks. Here was the explanation of the blast. Cakes of rust, sliding along the inside of the tank as the vessel rolled in the swells, had produced the sparks that touched off the accumulated fumes. Now, rust is carefully removed from the insides of such ships.

IN 1932, another disaster at sea taught its lesson. Sailors aboard the U.S.S. *Colorado* were engaged in antiaircraft practice when the big gun they were aiming aloft backfired. Five men were killed. A naval board consisting of ordnance experts, engineers, and veteran officers, investigated and found that the breech of the gun had not been closed tightly. Now, gun crews serve their pieces secure in the knowledge that automatic locks hold breechblocks tightly in place, even when they are only partially closed by the operators.

A number of years ago, the U.S.S. *Mississippi* was steaming in formation with other ships on the Pacific Ocean. Crews worked with machine precision in the fourteen-inch gun turrets, trying for a gunnery record. Suddenly there came a flash of fire, a roaring blast, and forty-one men died within the narrow confines of the turret.

Scrutinizing every inch of surface on and around the gun, engineers found that the compressed air, which cleans the bore after each round, had failed. A burning fragment of cloth from a powder bag had set fire to the incoming charge. Many of the doomed men would have escaped if the turret had been equipped with a hatch leading to the deck. Such an avenue of escape has been developed as a result of the disaster.

Occasionally, freaks of fate and inexplicable whims of chance produce a chain of events that adds to the difficulty of an engineering detective's work. An instance of the kind occurred not long ago in Chicago.

In a large cold-storage plant, a generator burst into flame. The engineer in charge slapped down the throttle to stop the generator. At that moment the sixty-two-inch flywheel burst. Fragments shattered an oil separator; the oil ignited; ammonia gas exploded violently; girders were blown from their moorings, and a concrete sidewalk was torn up for the length of a city block.

DURING the last two decades, some 400 dust explosions, incident to the handling, milling, and processing of agricultural products, have taken a toll of 320 lives. Following one terrific blast at a midwestern grain elevator, small pieces of metal were found mixed with the grain. Bumping along the chutes, they had produced sparks that touched off the explosive dust. Now, magnetic separators and inert gases, which reduce the oxygen content of the air at danger points, have gone far toward removing the menace of dust explosions.


Throughout their work, the main aim of the engineering detectives is to prevent the recurrence of tragedy. Thanks to these sleuths of science, accidents are less likely to repeat themselves. By solving mysteries of the present, they provide safeguards for the future.

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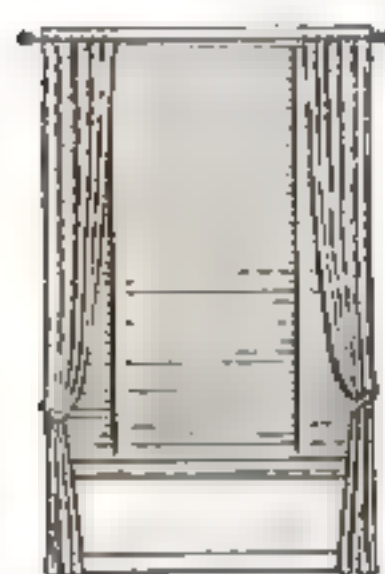
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STUDYING SPIDERS UNDER YOUR MICROSCOPE

(Continued from page 59)

treme posterior end of the spider's abdomen.

Perhaps the most interesting part of the spider's abdomen is a set of tiny openings grouped into six projecting "spinnerets." In the abdominal cavity are silk glands in which is produced a fluid that hardens into the familiar web silk upon contact with air. Each of the six spinnerets contains scores of very tiny holes, through which the fluid flows. The tiny strands from the holes unite into a larger strand, and these strands from the individual spinnerets, join with others to form a single thread. Spiders have remarkable control over their silk-spinning machinery, for they can



Embedding a spider in wax, in order to dissect it. A hot needle is used to melt the wax

produce strands of different size, and some spiders can spin, at will, threads coated with a sticky substance.

The wheel-shaped webs you often find glistening with jewels in garden or field on a dewy morning, are excellent examples of the spider's spinning art. These webs are composed of a number of straight threads radiating from a common center, like wheel spokes, and connected by other strands running spirally, like the groove on a disk phonograph record. Touch the strands with your finger. The radiating ones do not adhere to your skin, but the spiral ones do. Stick two pins into a cork, so that their shafts are parallel and a half inch or so apart, and with this instrument collect a few strands from the web, both radiating and spiral ones. Examine them under the microscope.

NOW you can see why the spider was one of the world's first inventors; it produced the earliest known "fly paper." For, under the powerful lenses of your microscope, you can see that the sticky parts of the web are really strings of microscopic beads spaced with remarkable precision along a silken cord. Large and small beads may alternate. Each bead is a tiny droplet of a sticky substance secreted by the spider. The purpose of these tacky threads is to catch and hold any fly or other insect that is foolish enough to meddle with the web. The radiating threads of the web are not covered with sticky beads; their job is to support the web and not to capture prey. Not all webs, however, are constructed with fly-paper threads.

The technique of the spider in capturing a fly or other prey displays a considerable instinct for military strategy, just as its web building shows the influence of good engineering. The spider sits in the center of its web or hides in its silken tunnel, and waits for its carefully constructed silk net to pick up something. A leaf falls and is trapped, but the spider pays no attention to it. Then a fly becomes ensnared, and the spider goes into action. It darts out and quickly wraps the captive in a silken strait-jacket. Then it administers a "hypodermic injection" with its poison fangs. The dinner follows at leisure, and finally the dry (Continued on page 112)

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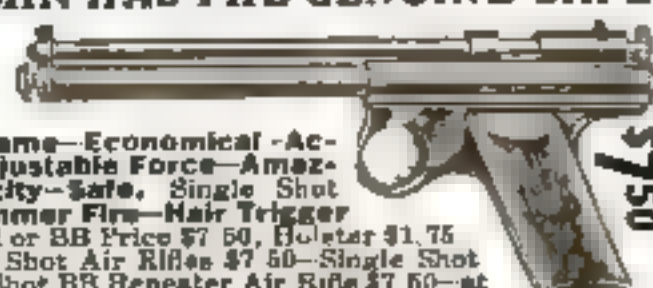
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STUDYING SPIDERS UNDER YOUR MICROSCOPE

(Continued from page 111)

carcass of the victim is left as a trophy of the spider's prowess as engineer, strategist, and trapper.

The act of subduing the captive by spinning silken threads around it calls attention to a detail of the silk-spinning equipment. You will remember that each spinneret is pierced by hundreds of holes through which the silk-forming fluid flows. Because the fluid emerges in very tiny strands, it hardens almost instantly to produce a larger strand of great strength. Were the fluid to flow out through only a few larger openings, air could not get to it immediately, hardening would be slow, and the spider could not spin its thread with lightninglike rapidity.

IF YOU want to dissect a spider or other insect to see what is inside, a convenient way of holding it is to embed it partially in wax. Melt a little paraffin or beeswax in the center of a one by three-inch glass slide, preferably a hollow-ground one, and let it cool. Lay the specimen on it, arrange it as you desire, and touch the wax with a hot needle. The molten wax will "wet" the adjacent surfaces of the specimen, and upon cooling will hold it securely.

Actual dissection of such tiny objects as a spider's abdomen can be accomplished easily with instruments made from a glass tube. Heat a length of small-diameter glass tubing over a gas or alcohol flame, and draw it out into a hairlike strand. Break the strand so that it forms sharp cutting edges. Examination of the tubes with the microscope will reveal whether or not they have suitable cutting edges. By repeated trial, excellent scalpels can be produced.

The wax should be built up around the edges so that it forms a tiny saucer, with the spider near the middle. This serves to retain a normal salt solution (0.7 to 0.9) grams of table salt to 100 cubic centimeters of water) with which the specimen is flooded during dissection.

You do not, however, have to capture and kill a live spider in order to investigate its structure with the microscope. As if it knew millions of years ago that microscopists some day would be wanting to peer at its fangs and legs and body hairs and other external details through their magic lenses, the spider developed the habit of shedding its skin periodically. This habit is useful to the spider, for it enables it to discard one skin for a larger one as it grows bigger, and it helps the microscopist because this shed skin carries with it a great many details of the surface of the body and its appendages.

You can find spider skins in almost any web. They look, at first glance, like dead, dried-up spiders. You must handle them with care, for they are very fragile. Frequently it is possible to see structure more clearly in these skins than in live specimens. An example is the hinge construction of the poison fangs, which shows up much more plainly in the discarded covering because it is more transparent.

To make permanent mounts of spider skins, simply moisten them with xylol until all air bubbles have been expelled, and mount them in balsam.

PERHAPS you will want to make permanent mounts of some of the organs you remove from spiders or insects, or of bits of tissue from larger animals. You can save much time by employing the new dioxan method of preparing them.

The use of dioxan in microscopic technique is a process, just now coming into popularity, that threatens to replace the familiar alcohol method of dehydration, and to alter the process of fixing tissue (Continued on page 113)



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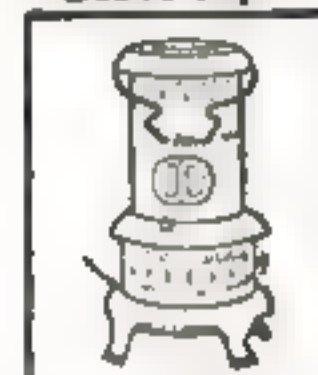
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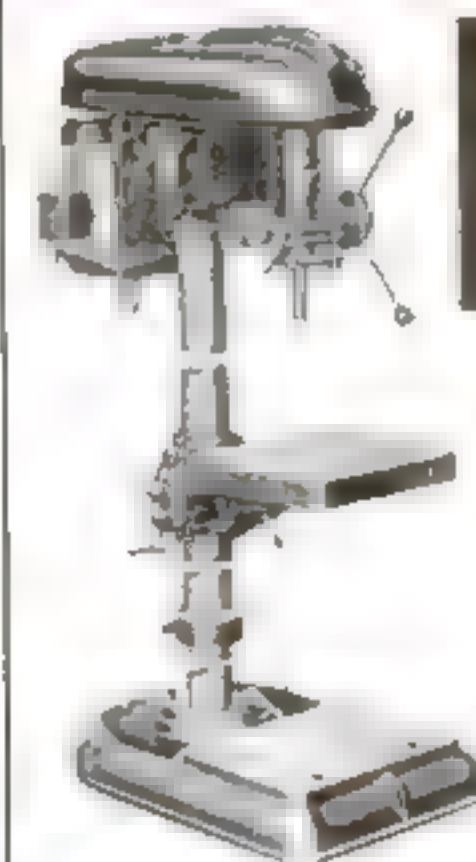
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(Continued from page 112)

Dioxan is the common name of diethylene dioxide, a waterlike liquid that can be used in place of alcohol and xylol in microscopic technique. It mixes freely with water, alcohol, xylol, paraffin, and balsam. Dioxan is inflammable and slightly anesthetic, so that you must use it with ordinary caution. It is not expensive, costing about twenty-four cents a pound (about one pint), not including bottling and shipping charges.

A ROUTINE that works well with parts of spiders, and similar specimens is begun by fixing the specimen from one to three days in a standard solution, such as picric-alcohol. This can be made up by mixing 500 cubic centimeters each of water and ninety-five-percent alcohol, and adding two grams of picric acid. When fixation is complete, the specimen can be stained, if desired, in eosin, or other dye, after which it should be rinsed in water.

The dioxan in the jar extracts all water and alcohol from the specimen, and the calcium chloride, in turn, extracts them from the dioxan. Thus the dioxan does not become exhausted, and can be used over and over again. The calcium chloride, however, will begin to crumble in time. When this happens, remove it, filter the dioxan, and add fresh chloride.

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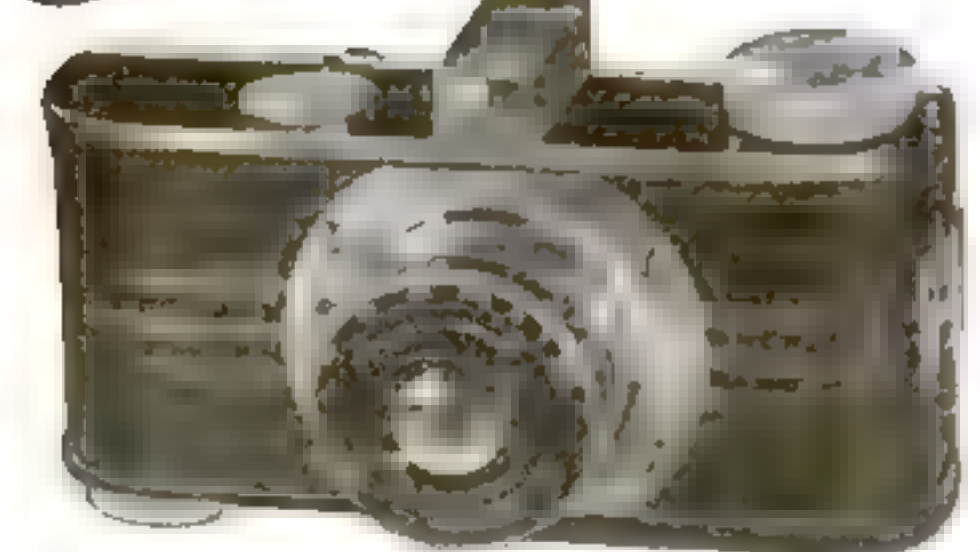
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HOW TO GET GOOD SHOTS WITH A SMALL CAMERA

(Continued from page 100)

pared, and it is a good idea to start with one of them. Later, if you wish to experiment with mixing your own developer, you will then have some standard of comparison.

Directions for miniature negative development are given in many handbooks and, in fact, are supplied with most of the special developers. They all lay stress on the importance of keeping the temperature of the solutions always at a given point, usually in the neighborhood of 65 deg.

It is easy enough to keep the developing and fixing solutions at this point, but the beginner may well be puzzled over the problem of how to keep the wash water at this same temperature.

A PRACTICAL solution of this problem is suggested in a drawing on page 90. A 5-gal. bottle is filled with a mixture of hot and cold water till the temperature of the liquid is at the point desired. Then the water is allowed to siphon slowly into the film tank, the rate of flow being regulated by a shut-off valve made as shown. The valve is set so that all the water will flow through in about fifteen minutes.

With the aid of this arrangement you can process the film entirely at one temperature and thereby obtain the finest possible grain in the image. The use of wash water colder or hotter than the developing and fixing solutions has been found to increase the grain size.

Aside from the greater magnification required, the enlargement of miniature camera negatives differs in no important particular from the enlargement of bigger negatives save for the greater care that must be taken to eliminate every speck of dirt and dust from the film and from the glasses that hold it.

Never handle either the glasses or the film itself except by the extreme edges. If you do by accident get a greasy finger mark on the film, remove it at once with carbon tetrachloride on a soft clean cloth.

Just before you put each negative between the glasses of the negative holder, carefully dust each side of each glass and the film itself with a 1-in. camel's-hair brush.

One trouble that has driven many a miniature camera fan nearly to distraction is the effect of Newton's rings in causing mysterious shadows and blotches in his enlargements. These rings are a light-interference effect that may occur when any two clean, flat, transparent surfaces are placed in close contact.

ONE illustration shows a photograph of a greatly enlarged group of Newton's rings actually produced between the back of a miniature negative and the glass that was pressed against it. The rings have all the brilliant colors of small curving rainbows, but of course they reproduce in the photograph only as shades of gray.

Newton's rings may appear in any size and any sort of irregular curved shape, so if you suddenly discover that the enlargement you have just made from a miniature negative shows an odd blotch of shadow that has no counterpart in the negative when carefully examined by direct light and not in contact with any glass, lay the negative face down on a clean piece of paper and carefully rub the back with talcum powder on a piece of clean cotton. Dust off every visible speck of the talcum and try another enlargement. You will find that the shadow has disappeared.

Probably the reason why this works is because pieces of talcum so microscopically small that they cannot show in the enlargement become embedded in the film back and keep the film from making a sufficiently intimate contact with the back glass to produce the Newton's rings.

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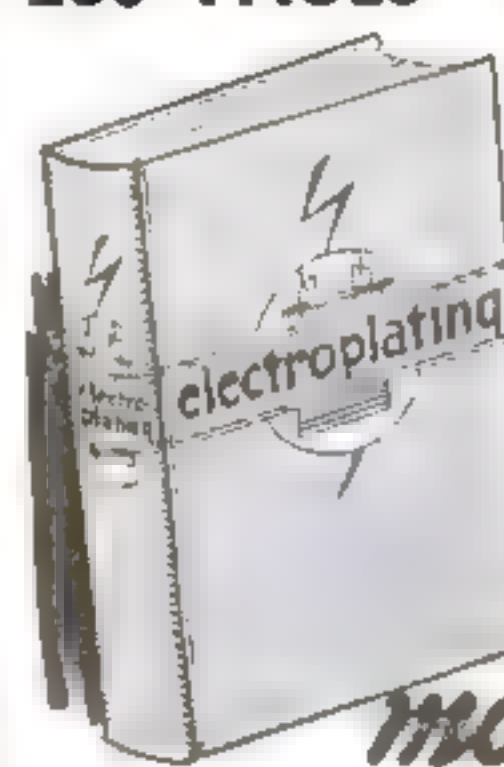


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A boatload of sheep about to be hoisted to the level of the steamer's deck for driving aboard

COWBOYS OF THE SEA

(Continued from page 29)

the boat, he tosses the short lasso to the man in the bow, who in turn passes it back to one of the crew. In jig time, the steer is tied fast, horns against the gunwale, and the cowboy starts back for another. When six steers have been tied in place, a motor launch tows the boat out to the waiting ship.

Once alongside the *Humuula*, crew members fasten rope bellybands under the steers, and they are lifted into waiting pens on the forward deck. Wooden spreaders hold the two ropes of the band apart, thus preventing any slippage that might injure an animal. As soon as a load of 100 steers has been taken aboard, usually in late afternoon, Capt. Willy Punahoa turns the cattle boat's prow seaward for the overnight voyage to Honolulu.

Through a century of practice, both the cowboys and the horses become skilled in handling the cattle. The cowboys are natives of the islands, some of them being Chinese-Hawaiians, others Portuguese-Hawaiians. Since ordinary equipment would not withstand such rough usage, the cowboys ride in wooden saddles which do not swell and buckle under the tropical sun. Their horses are Percherons, bred on the island and trained for water work. They are responsible for driving the cattle from the hills and alongside the small boats. There their job ends, to be taken over by crews of hand-picked Hawaiian boatmen.

SHEEP are more easily handled than cattle. Many are reared on bleak Kahoolawe Island, off the lee coast of Maui, 100 miles from Honolulu. On shipping day, a small boat pulls alongside the dock and the sheep follow a leader over the side. At the cattle boat, the launch is raised to deck level and the sheep are turned into a runway leading to deck pens.

Cattle overrun the Parker ranch, to the number of some 40,000, while the 14,000 sheep hide in the mountains and are seldom seen. Although high wire fences are used to prevent the cattle from wandering off into deep ravines or across the mountains, occasionally a bull will break down a barrier and wander off to join a wild herd on the slopes of Mauna Loa. These wild bulls avoid man whenever possible, but if a cowboy attempts to rope one of them, the bull will attack viciously.

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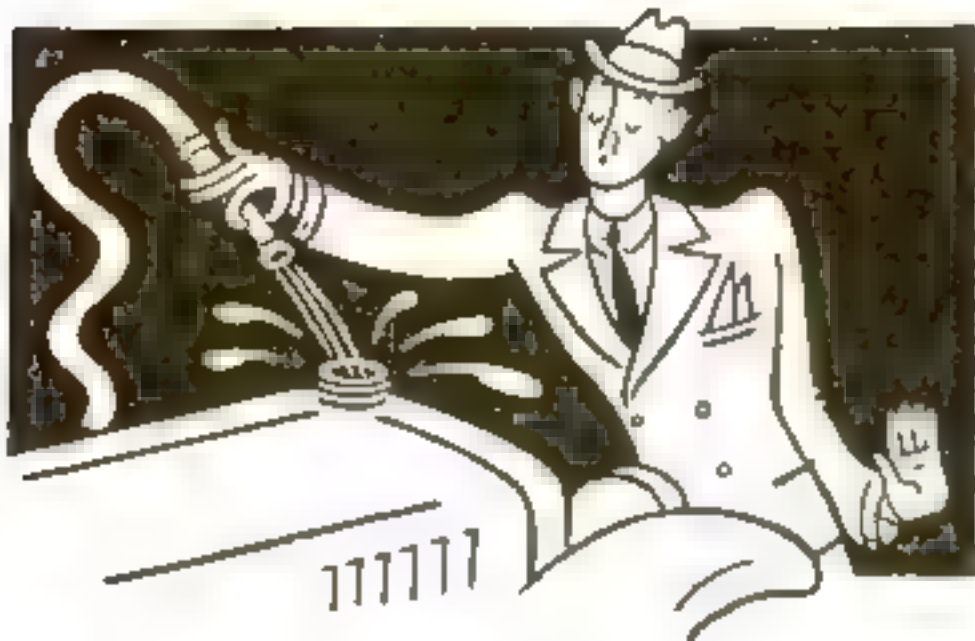
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YOUR EYES DECEIVE YOU

(Continued from page 39)

A. Wohlgenuth of the University of London, has uncovered enough facts to fill a whole book he has written on this mysterious illusion. The imaginary motion, he finds, always takes place in the opposite direction to the motion you saw. Practice improves your ability to perceive it. It starts immediately after the real motion has stopped. To perform the paradoxical feat of measuring how fast an object appeared to be moving when it was actually standing still, the experimenter revolved an eight-inch disk before a subject and then stopped it. While the subject saw it apparently turning backward, the investigator matched the illusion by slowly turning a second disk at the speed that his subject called for. Knowing the speed of both disks, he discovered that a real motion of a given speed produces an illusion of reverse motion about 1/150 as fast. Not many other laboratory workers can boast of holding a stop watch on a fleeting illusion!

HAVE you ever gazed at a waterfall and noticed that rocks and trees beside it seem to be moving in the opposite direction to that of the water? Does the moon sometimes seem to you to be sailing across the sky, when wind-blown clouds are streaming in front of its yellow disk? Crossing over a stream on a log, were you ever thrown off balance by the impression that the log itself was moving upstream? Do you get a giddy feeling when you are standing on a station platform and a fast train rushes by? All these are common ways in which people experience the "waterfall illusion," as it is known to psychologists. It represents your eyes' attempt to compensate for motion in one part of your field of view by imagining a contrary motion in another.

Why some people object to riding backward on a train may be explained by the same illusion. Suppose you are sitting in the rear of a coach, facing forward but noticing the passing scenery out of the corners of your eyes. Presently you may notice that the forward end of the coach appears to be stretching away from you. This does not annoy you, because the illusion seems to give you more room. Now suppose, instead, that you are sitting in a front seat and facing backward. This time, the rear of the coach will appear to be advancing toward you. In this way, it is believed, nervous people may get the impression that the car is crowding in on them. By facing forward, they avoid the bothersome illusion.

When giant searchlights probe the night sky with brilliant fingers of light, their beams often seem to end abruptly in mid-air, as if colliding with some invisible obstacle. Nearly everyone has noticed this curious effect, either at first hand or in photographs of searchlight displays. Even searchlight operators thoughtlessly assumed the phenomenon was caused by fog or haze in the atmosphere, until Dr. Enoch Karrer, Western Reserve University physicist, unmasked it as one of the trickiest of optical illusions.

WHAT fools you, he points out, is the shape of the beam. Army searchlight operators have orders to make it parallel—that is, not spreading or tapering but with one side of the beam parallel to the other. This is not so easy to do. When the man behind the light thinks that he has adjusted it according to his instructions the beam often really has the shape of a giant cone.

How far is it to the place where the beam looks cut off? Your eye, like that of the searchlight operator, mistakenly assumes the shaft of light to be parallel. Now, experience tells you that anything with parallel sides, like a long, straight road, appears to taper to a

point as it stretches into the distance. The searchlight beam does not taper to a point. Therefore, you reason, it must end near-by. You are content to accept this misleading evidence because there is no other clue to the true length of the cone-shaped beam.

If distance markers are equally spaced along the searchlight beam, as in an accompanying diagram, the deception vanishes. Now you can see that the sudden ending of the beam is nothing but an optical illusion. It actually stretches on and on as far as you can see.

NOTICE too, in the diagram explaining the "searchlight illusion," that the conical beam and the parallel beam look askew, despite the fact that they are pointing in the same direction. That is why searchlight beams in actual photographs frequently appear to shoot out at angles that do violence to all the laws of perspective.

If you are watching a lawn sprinkler in action, and it seems to turn first in one direction and then in the other, you are seeing a modernized version of the "windmill illusion." In the days when windmills were common, buyers frequently complained that the vanes would not keep turning the same way, but kept reversing themselves. The explanation is simply that the near and far sides of an object like a windmill's set of vanes are easy to confuse, when it is viewed at a slant some distance away. One minute you think the left-hand side is the nearer one; the next minute, the right-hand side. Therefore though the windmill is revolving steadily, it seems to your eyes to spin first one way and then the other.

A queer illusion that "freezes" revolving objects and makes them seem momentarily to be standing still has only recently been accounted for. Walking down the street some day, you may notice that a rotating fan in a building wall, or the wheel of a moving automobile, appears to stop for an instant and then to resume turning. You also may observe that the peculiar effect coincides with each step you take.

Dr. Milton Metfessel, State University of Iowa psychologist, solved the mystery. Hung as it is in a cradle of muscles, the whole eyeball vibrates as if it were on springs when it is jarred. The result is what scientists call a "stroboscopic effect"—in other words, the same thing that happens if a motion-picture camera takes sixteen pictures a second of a sixteen-spoke wheel revolving just once a second. When the film is projected, the wheel appears stationary. Intermittent flashes of a spinning object impressed upon the retina or sensitive surface of the eye, as it vibrates, also produce the effect. By applying an electric vibrator to a subject's head, Dr. Metfessel has evoked the "stroboscopic illusion" with startling vividness. It can be brought on, however, merely by the jar of a heavy walking step or by movements of the jaw in talking.

SIT in front of a blazing log fire, and you may suddenly see the fire screen move backward a foot or two, right into the flames! If you practice looking for this illusion, you may even see a third screen clear behind the fire. The explanation of this illusion offers an interesting sidelight on binocular, or two-eyed, vision.

Move a pencil toward and away from your face, and you can physically feel the range-finding mechanism of your eyes in action. Your eyes converge until you can combine or "fuse" the left and right-eye images of the pencil, wherever it is. At this moment an automatic calcula-

(Continued on page 117)

YOUR EYES DECEIVE YOU

(Continued from page 116)

tor in your brain notes the angle at which each eye is turned, performs a lightning calculation just as if it were finding the range for a big naval gun, and informs you how far away the pencil is. This is the mechanism that gauges the distance for you whenever you touch or grasp an object. Smoothly as it works, it sometimes makes mistakes.

Hold two pencils of identical appearance, with their ends even and parallel, a few inches apart and in front of your face. With a little effort you can concentrate upon one of them with each eye, "fusing" the two images into one. Then, between the two real pencils, you will see a third and wholly imaginary pencil several inches farther away! Your eyes have mistaken the two pencils for a single one, and their distance-finding mechanism has been tricked into giving a false report.

SIMILARLY, adjacent meshes of the fire screen look almost exactly alike. To gauge the distance of the screen correctly, your eyes must converge upon the same opening. If your left eye picks out one mesh and your right eye, by mistake, the one adjoining, you will see the phantom screen in the fire; the spread of your eyes that combines or "fuses" the two meshes would normally correspond to a screen at this distance.

When your senses disagree, prepare to see an optical illusion! One scientific observer, aboard a rolling ocean liner during a stormy voyage, noticed the opposite wall of the lounge visibly rising and falling as if viewed from a perch on a moving seesaw. This did not seem strange until she realized that the night was inky-black; that nothing could therefore be seen through the windows of the vessel; that no interior fixtures were moving or swaying; and that, in consequence, there should have been no more visible motion than in a totally enclosed elevator. For this experience, which many voyagers have shared, there could be only one explanation. The rolling of the boat sets up corresponding movements of the watery fluid in the semi-circular canals of the inner ear, which serves as the human body's organ of balance. This organ correctly reports to the mind that the body is alternately tipping forward and backward. The mind passes on to the eyes a demand for what they would ordinarily see under the circumstances—and the eyes obediently "see" what is expected of them!

WHAT happens when you see the room "going around" after you have spun rapidly on your feet, or have been whirled on a revolving piano stool? Much the same thing, in all probability. The watery fluid in the canals of your inner ear is still spinning, thereby giving you the physical sensation that the room itself is turning. Accordingly, your mind expects to see the walls revolving, and your eyes do not disappoint it.

Scientists would like to delve more deeply into the cause of many optical illusions. Just what parts do the eyes and the mind, respectively, play in producing each one? So shadowy is the border line between the physical and the mental that the question often is far from easy to answer. Take one of the simplest of geometrical illusions—the way a line seems to be shortened or lengthened by adding streamers pointing inward or outward at its ends. Do we get the wrong impression of the line's length from the physical movements of our eyes in following the pattern? Or does some mental quirk give us a false interpretation of what our eyes see correctly? Research workers have debated the point for fifty years, but still await some ingenious test that will settle it. Meanwhile, on one thing, all are agreed—don't believe your eyes!



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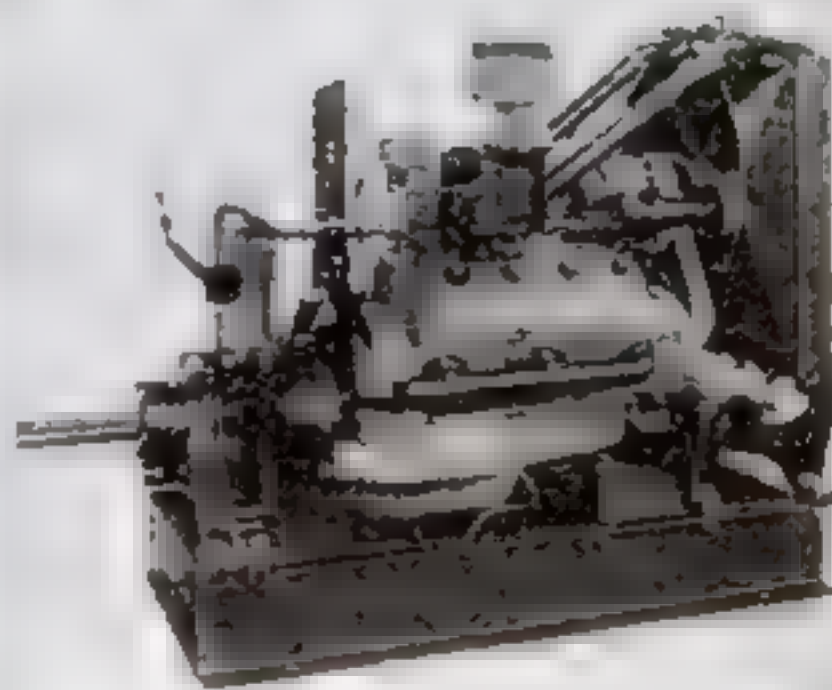


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HAS THE TRAILER COME TO STAY?

(Continued from page 41)

disappeared with the automobile, hitch-hiked his way for thousands of miles, attaching his "house on wheels" to the cars of tourists and sharing the expenses of the trip!

Just over the North Carolina line, at a small camp, I talked with a trailer philosopher, a man about seventy years old, who had built his first outfit and had bought two others since. He was completely "sold" on the life of a motor gypsy. With social security, endowment insurance, and old-age pensions on the increase, he pointed out, life and leisure for thousands of couples with small but regular incomes will begin with the purchase of a trailer. Legislation, he thought, is the most uncertain factor. Upwards of 10,000 laws are being proposed in Federal, state and city legislative bodies for the regulation of trailers.

HOW will trailers be taxed? How will children from these roving homes be educated? Is the whole trailer movement just another fad, another miniature-golf craze? Or does it really offer something in the way of freedom, economy, reduced housework, to give it a steady and lasting appeal?

Those are questions which we have been asked over and over again since our return. It is a significant fact that the people we met who had lived longest in trailers, were the most enthusiastic about them.

At present, however, the trailer is the problem child of transportation.

Hotel men view with alarm these rooms on wheels speeding past their doors; restaurant owners sniff with displeasure the odor of cooking food in trailer camps; tax collectors see with consternation thousands of families rolling from community to community in tax-free trailers. School officials are faced with the problem of wandering pupils; health officers with the possibility of "trailer slums" where epidemics will find a breeding place; highway officials with clogged arteries of traffic caused by an increase in the number of towed vehicles.

In one southern camp, we talked to a boy who had gone to school in twelve different states. He would enter school, go a few weeks or months, and then his family would hook up the trailer and roll on into another state where he would begin all over again. In California, the trailer is blamed for adding 50,000 pupils to the school enrollment. It is obviously unfair for taxpayers to have to support schools for children from tax-exempt trailers. Florida is now charging the children of trailer tourists four dollars a term for grammar school and eight dollars a term for high school.

HOW many people eventually will live in trailers? I asked that question of a good many of the old-timers with whom I talked. Few seconded Roger Babson's prediction that fifty percent of the people would live on wheels a generation hence. Many of them thought that about as many people will own trailers as now own motor boats. Even so, these rolling homes are bound to produce great changes. For example, a new type of filling station has been designed for trailer patronage. Canopies are eliminated; extra space is provided between the rows of pumps, and the driveways are on a level with the street.

When we crossed the long bridge across the Potomac and turned into the camp at Washington, D. C., a flurry of snow had covered the ground. Only a few trailers squatted under the overhead cables, smoke pouring from their chimneys. We pulled up in the same spot we had occupied on our way south, and spent the night comfortably warmed by our charcoal stove. The car was left hooked up, ready to start before dawn on

the last lap, the 250-mile trip that would carry us home.

We had decided to take New York City in our stride. After navigating the narrow streets of St. Augustine, I felt like the mouse that nibbled the distillery mash and then squeaked: "Bring on that cat!" Instead of shinking through New York before dawn, we planned to ride up Broadway with traffic at its peak!

It was half past six the next morning before we finally got under way. By seven, the white dome of the Capitol was far behind us and we were speeding down Maryland roads toward Baltimore. The hurdle of its traffic was passed even before the nine-o'clock rush of office workers and, long before noon, we were running beyond Elkton, mecca of eloping couples, where every farmhouse seems to carry a huge sign: "Minister—Marriage Licenses—Inquire Within."

ON OUR first day in a trailer, we had jotted down the name of a filling station near Jersey City, N. J., which had an open space at the back. We planned to spend the night there going home and make another dash through Manhattan before dawn. Now, with the confidence of a veteran trailerite, I skimmed past the place and bowled along down the road to the Holland Tunnel.

At the other end of the tube, we emerged into the maelstrom of trucks and taxis, into the swirl and rush of traffic in the second largest city in the world. Pedestrians swarmed on the sidewalks like ants from a disturbed nest. Taxis dodged in and out, sheared off, came to sudden stops. Pushcarts threaded their way through stalled traffic. Signal lights blinked red and green.

In a long series of starts and stops, we moved up Seventh Avenue to Times Square. There we swung over onto Broadway. From then on, it was something like riding a steam calliope in a circus parade. Trailers might be a commonplace to the rest of the country, but to Manhattan they were still covered with the dew of novelty. Whenever traffic came to a halt, little crowds collected around us. Chauffeurs plied us with questions. Once both a taxi driver and his passenger were giving us a friendly third degree that was interrupted when the lights switched green and we moved ahead with traffic.

Handling the trailer in the midst of the thousands of vehicles was not particularly difficult. It was simply a question of keeping to the lane first chosen and easing into the turns gradually. An hour after we left the Holland Tunnel, we were rolling across the black span of the Queensboro Bridge. Less than twenty-five miles remained between us and the end of our journey.

DUSK was falling when we reached home. While a welcoming committee of neighbors offered advice, I swung the nose of the car from side to side and maneuvered the trailer back into the driveway. Then, we unloaded the loot of the trip: sugar cane from Georgia, grapefruit from Florida, Virginia peanuts, and a baby alligator we called "Mr. Jim."

During our five weeks on the gypsy trail, we had traveled as far as from coast to coast and half way back again. We had lived in a new world of mobile homes. And, we had had more than a month of fun and travel with but a single day of trailer trouble to mar our pleasure.

The following morning, I returned the trailer to the agency from which it had been rented, and that afternoon had the hitch removed from the car. Our adventure on wheels was over.



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SPANISH MOSS IS NEW UPHOLSTERING MATERIAL

(Continued from page 33)

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Placed in long windrows, the moss is watered from time to time. As the outer coating rots away, tannic acid is formed. This cures and tans the wiry inner core, turning it black and strengthening it. The darker the cured product, the stronger it is and the higher the price it commands.

During the curing process, which may last anywhere from two to six months, the piles are turned occasionally to make the action of the acid uniform. Care also is taken to prevent overheating, as this makes the fibers brittle and detracts from their value. Approximately ninety percent of the weight of the moss is lost during curing, drying, and ginning. Thus, the 200,000 pounds of the finished product shipped each year from the Gainesville gin represents upward of 2,000,000 pounds of moss as gathered from the trees.

AS SOON as the curing is complete, the windrows are opened up and the black fibers are spread out to dry on the ground, on fences, or on special wire lines stretched across the field. Two or three days of sunshine leave the moss ready to go through the gins. These electrically operated machines comb out all the bark, sticks, burrs, trash, and remains of the outer coating which adhere to the inner core. Blowers remove the dust and leave only the clean, crisp, inner thread which is pressed into 200-pound bales for shipment north.

A recent discovery made in connection with ginning Spanish moss is that the refuse material is valuable as a mulch around the trees in citrus-fruit groves. It also is being employed as a fertilizer to add organic matter to sandy soils.

New uses for the cured moss are rapidly being added to the list. Not long ago, a manufacturer of air-conditioning apparatus began experimenting with the moss "hair," coating it with adhesive material to produce a filter for straining out dust and pollen.

Another new application is reported from Massachusetts, where a large oil concern is using as much as 1,500 pounds of cured moss a month to strain out impurities from motor oils.

In upholstery work, which probably absorbs more than ninety percent of the moss sold each year, two of the most recent developments have been interlacing Spanish moss with burlap, and molding it with latex, the milky-white fluid that is obtained from the rubber tree.

In the former process, the moss is rapidly fastened to burlap by punching some of the fibers through the heavy cloth. In the latter, the vegetable hair is treated with latex and molded into various shapes to provide springy cushions for the seats of airplanes, busses, and trains. Sheets of this material, two and a half inches thick, also are being tried out in mattresses. They form the outer layers of the mattress sandwich, the "filler" being placed between them.

OCCASIONALLY, an order comes in for green, uncured moss. One eastern varnish company, for instance, orders three or four bales a month. They are made up specially at a southern plant. The moss is used in place of sandpaper to produce an extra-smooth finish on varnished floors.

In fact, I was told by a representative of the American Moss Company, largest distributors in the East, new uses for the moss and the vegetable hair it produces are arriving so fast there is difficulty obtaining sufficient raw material at the gins. In the vast amount of Spanish moss which hangs from southern trees like living stalactites, a new industry is finding a source of wealth.



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HOMEMADE POCKET RADIO USES MIDGET PARTS

(Continued from page 67)

ate the outfit perfectly, the high resistance may cause the resistance-coupled amplifier to howl constantly. The electrolytic condenser prevents this howl and makes it possible to use a battery until its voltage gets too low to power the receiver. The condenser is placed at the end of the case next to the "A" battery.

The actual wiring of the circuit is simple, entirely conventional, and easy to follow. As far as possible, the small condensers and resistors should be rigidly supported. For example, condenser C_7 can be glued to the side of the case beside the XY tube.

When the connections have been completed and carefully checked, the set is ready for operation. If wired properly, it should work on the first trial, as no adjustments are necessary. The potentiometer (R_2) is the regeneration control. If oscillation cannot be obtained by adjusting it with or without an antenna connected, the leads to the coil L_2 should be reversed.

TWO antenna posts are provided, A_1 is for general use with a long antenna, and A_2 is for operation with a very short antenna. The ground post G is seldom used.

Almost any piece of metal will serve as an antenna. In fact, very good reception in most cases may be obtained simply by running a wire from post A_1 to a water faucet, a radiator, or a wire fence. Even six to ten feet of wire connected to post A_1 and thrown on the floor will give surprisingly good results in many localities. If the set is used within fifty miles of a fairly powerful station, a magnetic loudspeaker often will provide good volume.

The parts required for building the receiver are as follows:

- C_1 , C_2 , and C_3 .—Fixed condensers, mica, .001 mfd.
- C_2 .—Fixed condenser, mica, 250 mmf.
- C_4 .—Fixed condenser, .25 mfd, 200 v.
- C_5 .—Electrolytic condenser, 8 mfd, 200 v.
- C_6 and C_7 .—Fixed condenser, mica, .01 mfd.
- C_8 .—Midget variable condenser (see text), 250 mmf.
- R_1 .—Fixed resistor, carbon, 1 meg., $\frac{1}{2}$ watt.
- R_2 .—Potentiometer, carbon, midget, .5 meg.
- R_3 , R_4 , and R_5 .—Fixed resistors, carbon, .5 meg., $\frac{1}{2}$ watt.
- R_6 .—Fixed resistor, carbon, 20,000 ohm, $\frac{1}{2}$ watt.

L_1 and L_2 .—Tuning coil, iron-core type.

R.F.C.—Radio-frequency choke, 10 mh.

Miscellaneous.—Portable midget forty-five-volt battery, large-size flashlight cell, special sockets for midget tubes, one XSG tube, one XL tube, one XY tube, double-pole single-throw toggle switch, knobs, dial, pressed composition wood or other material for cabinet, wire, solder, lugs, etc.

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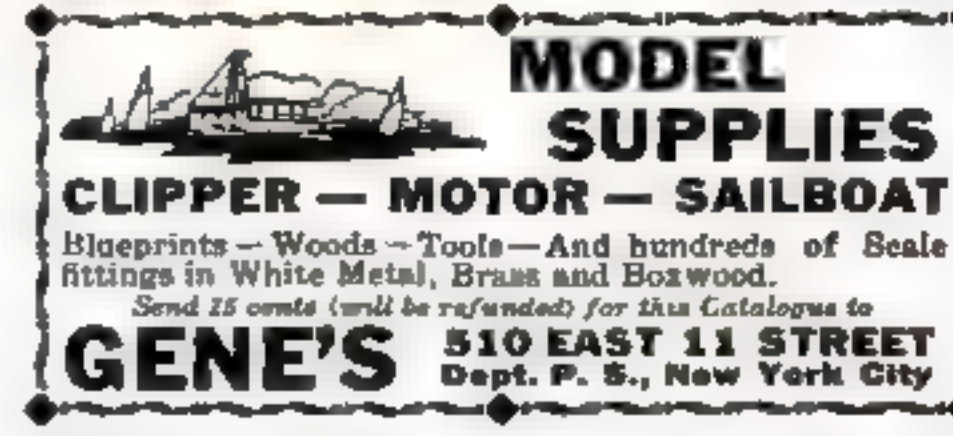
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SOME UP-TO-DATE TESTS FOR IGNITION TROUBLE

(Continued from page 68)

evidently the insulator has a tiny crack in it, so that the spark jumps away up inside the plug instead of at the points—compressed air being a tougher proposition for the spark to break through than ordinary air.

"That's what happens in your cylinder," Gus went on, as he chucked the bad plug into the scrap box and screwed the three remaining plugs into the tester. "When you open the throttle on a hill, the compression goes up and the missing starts."

"Cigars are on me, Gus," Nolan smiled, pulling a couple out of his pocket. "By jimminy, you have to keep right on your toes to follow all the changes in this automobile game, don't you? And some of the changes don't make sense to me. What's the use of running up the compression, if it's hard on the spark plugs and makes them break down?"

"THERE wouldn't be any use, if that was the only feature of high compression," laughed Gus. "It's just a case of sacrificing one advantage to gain more important ones. The public keeps demanding more and more speed and power, and gasoline economy at the same time. The only way you can get all three is to use a high-compression motor."

"As a matter of fact, there really isn't as much spark-plug trouble now as there used to be, because the quality of the insulation in spark plugs has been improved a lot. Did you check up on the breaker contact points?"

"Sure, I did," Nolan replied. "They're not burned so much, but more than on my old car at the same mileage."

"That's another place where the car makers have had to sacrifice one advantage to get others more important," said Gus, as he finished testing the last plug. "When you run up the compression, it takes more voltage at the spark plugs to jump the gap. On top of that, if you expect the spark to jump steadily at the very much higher speeds of today's cars, you've got to use a peppier coil that draws more current. But nobody has been able to find any better material for contact points than the tungsten that's been used for years, so the timer contact points in the modern car have to stand the gaff of a heavier current flow and the current kick-back from a more powerful coil. Naturally, the points won't last as long as they used to in the old days."

"And, I suppose, the faster you travel, the more wear there is on them," Nolan interrupted.

"The funny part of it is that it doesn't work that way," Gus corrected him. "The more often you start the motor, the more you let it idle, and the slower you go, the more wear there will be."

"That doesn't make sense, either," said the car owner. "What makes it work that way?"

It's easy to see why if you stop to figure a bit," Gus replied. "If the ignition system is designed so that it will make sparks steadily at high speed, it means that only a very short contact between the timer points is needed to get results. When you go slowly, the points contact longer than necessary, so that more than enough current flows, and that means more burning away of the tungsten."

"THAT'S clear enough," Nolan agreed. "But what about fellows like me, who aren't interested in all that speed and power? Couldn't we have new coils fitted that wouldn't be so peppery and take so much juice?"

"Sure, you could," Gus answered, as he put the wrench on the last plug and screwed it down tight. "But a better stunt than that, if you're having trouble with the breaker contacts giving out too quick, is to fit a rheostat in the primary circuit of the coil, with a short-circuiting switch (Continued on page 122)



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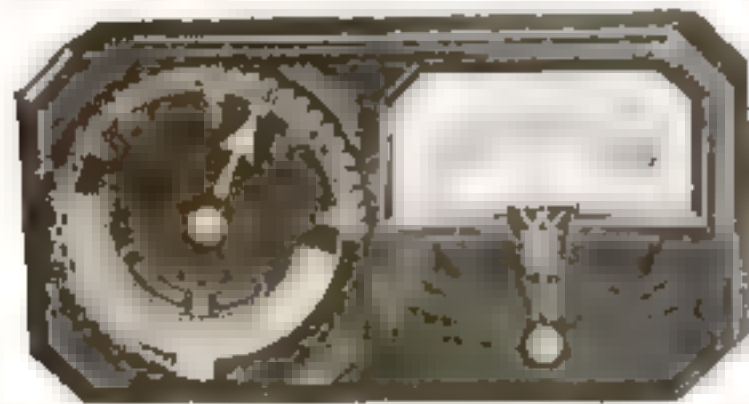
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SOME UP-TO-DATE TESTS FOR IGNITION TROUBLE

(Continued from page 121)

connected across it, so you can cut the current flow down to the minimum needed for your usual kind of driving. Then, if you do want full-power ignition for a quick start in cold weather, or for a bit of speed, all you have to do is flip the switch and you've got it without disturbing the rheostat setting.

"Incidentally," Gus added, "having the rheostat in the circuit brings other advantages. For one thing, it is a fine indicator of the condition of the timer contact points. When they begin to get worn and pitted, you'll find that you can't have nearly so much resistance and still get good ignition. And if you hide the rheostat up under the dash where it doesn't show, you can use it as a thief-stopper. Before you leave the car, you can turn the rheostat too far to give a good spark, and even if a thief has a key that will unlock your ignition, he isn't likely to figure out in a hurry why the motor won't start."

"SOUNDS interesting. Where can I get the right kind of a rheostat and switch?" Nolan asked.

"The rheostat ought to have a total resistance of about two ohms and be able to carry about five amperes continuously," Gus specified, "and any reliable toggle switch that will fit where you want it to go will do fine. You can get them both from a radio-parts supply house—ordinarily, there's no call for rheostats like that in the automobile business."

"How do I connect them?" Nolan asked, pulling out his notebook and pencil.

"Connect the terminals of the rheostat into the ignition primary circuit anywhere that it is convenient, like this," Gus directed, as he took the pencil and drew a diagram in the notebook. "Then you simply connect the terminals of the rheostat also to the terminals of the switch, so that when you throw the switch to the closed position, the rheostat will be short-circuited and the circuit will be the same as it was without the extra gadgets. Be careful, when you mount them, that neither the switch nor the rheostat is grounded on the metal dash, or you'll put the ignition out of commission entirely."

"Thanks, Gus, I'm going to try that," Nolan said, as he pocketed the notebook and pencil.

"Here's another worth-while tip on contact points," Gus volunteered. "It isn't a bad plan to inspect a new set of contacts after you've gone, say, a couple of hundred miles. If you see a tiny point building up on one of them, stone it off, without touching the rest of the contact surface if you can help it. Lots of times that'll save them from wearing out too fast."

"That's something else I'll keep my eye on," Nolan decided.

"And, speaking of dirty points," Gus grinned, "there's plenty of soot on the point of that long beak of yours, Tom!"

"Gosh!" gasped Nolan, as he glanced in the mirror over the washstand and immediately reached for his handkerchief. "So that's where the carbon collects nowadays!"

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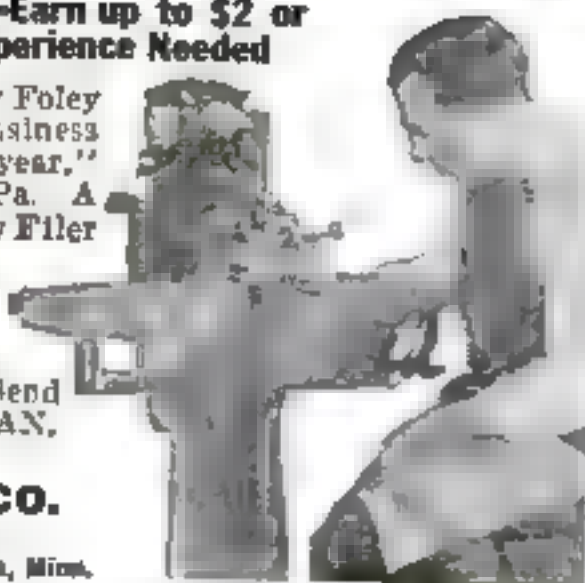
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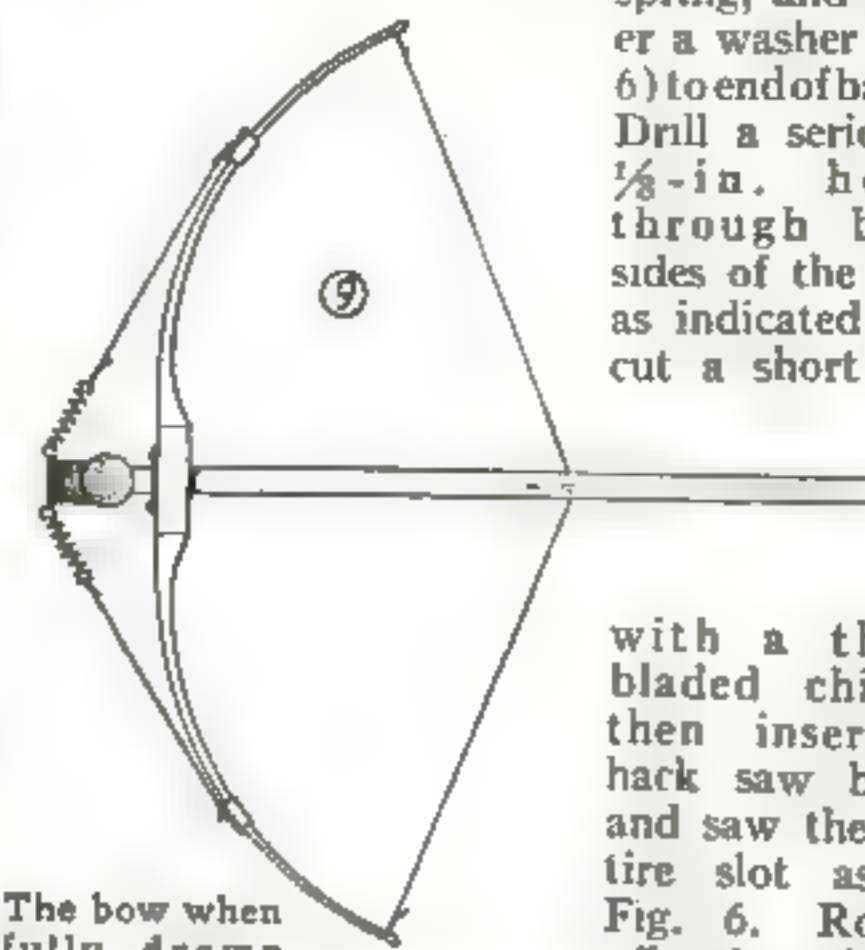
POPULAR SCIENCE MONTHLY
353 Fourth Ave. New York, N. Y.

AMAZING FLIGHT BOW

(Continued from page 80)

limb. Round the belly, but keep the back
perfectly flat. Sandpaper well.

Barrel. Bore a 3/4-in. hole as in Fig. 1.
Use a 30 in. length of 3/8-in. conduit pipe for
barrel. Make bracket of 1/16-in. thick flat
steel as in Fig. 4. Solder it to barrel 4 in.
from one end. Make handle as in Fig. 5, slip
the eye over short end of barrel, add the



The bow when
fully drawn

spring, and sold-
er a washer (Fig
6) to end of barrel
Drill a series of
1/8-in. holes
through both
sides of the pipe
as indicated and
cut a short slot

with a thin-
bladed chisel;
then insert a
hack saw blade
and saw the en-
tire slot as in
Fig. 6. Round
off sides of slot
so string will not

be cut. Slip pipe through hole in bow, glue
pipe inside the hole, and fasten bracket.

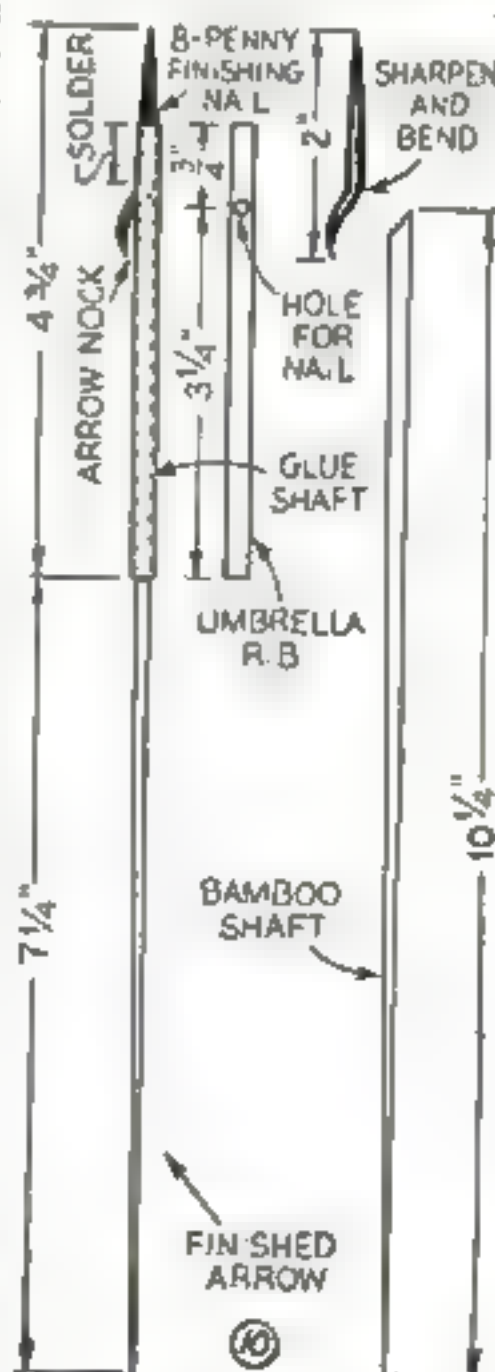
Springs. Make two clips from brass or
heavy tin (Fig. 8) to fit limbs of bow about
8 in. from tips as in Fig. 7. Put loop of boost-
er wire through hole in clip and insert pin or
nail. Be sure both clips are the same distance
from ends of limbs. Fasten a 1-in. section
of 3/4-in. diameter coil spring in each hole in
washer. Run ends of booster wires through
the hooks of springs. Pull wire taut and make
fast so that when the bow is drawn, the
springs will be stretched as in Fig. 9.

The size of springs given are for a bow of
from 30 to 40-lb. pull, but the springs should
be selected to suit the pull.

Strings. Form clips (Fig. 8) for bow tips
from tin or brass, solder the joints, and place
on bow so the overlapped portion is toward
the back. Glue on. The wire loops may then
be put on and the bow braced. (The bow
may be given a coat of white shellac, rubbed
down with steel wool, and finished with spar
varnish before the
clips and booster wire
are made fast.) The
size of the music wire
to be used as a string
will vary according to
the pull.

Arrow. Take a 4-
in. piece of hollow
umbrella rib and drill
a small hole in the
closed side 3/4 in. from
one end as in Fig. 10.
Bend and sharpen an
eightpenny finishing
nail, insert through
hole, and solder. Make
shaft of bamboo or
very tough wood and
insert in umbrella rib
up to hole. Glue it in
and slightly crimp the
sides of the rib. Tap-
er the shaft gradually
to the end.

Shooting. Drop ar-
row through the pipe
so that the nock or
hook will straddle the
string. The nock
should fit snugly on
the string.



The arrow and parts
from which it is made

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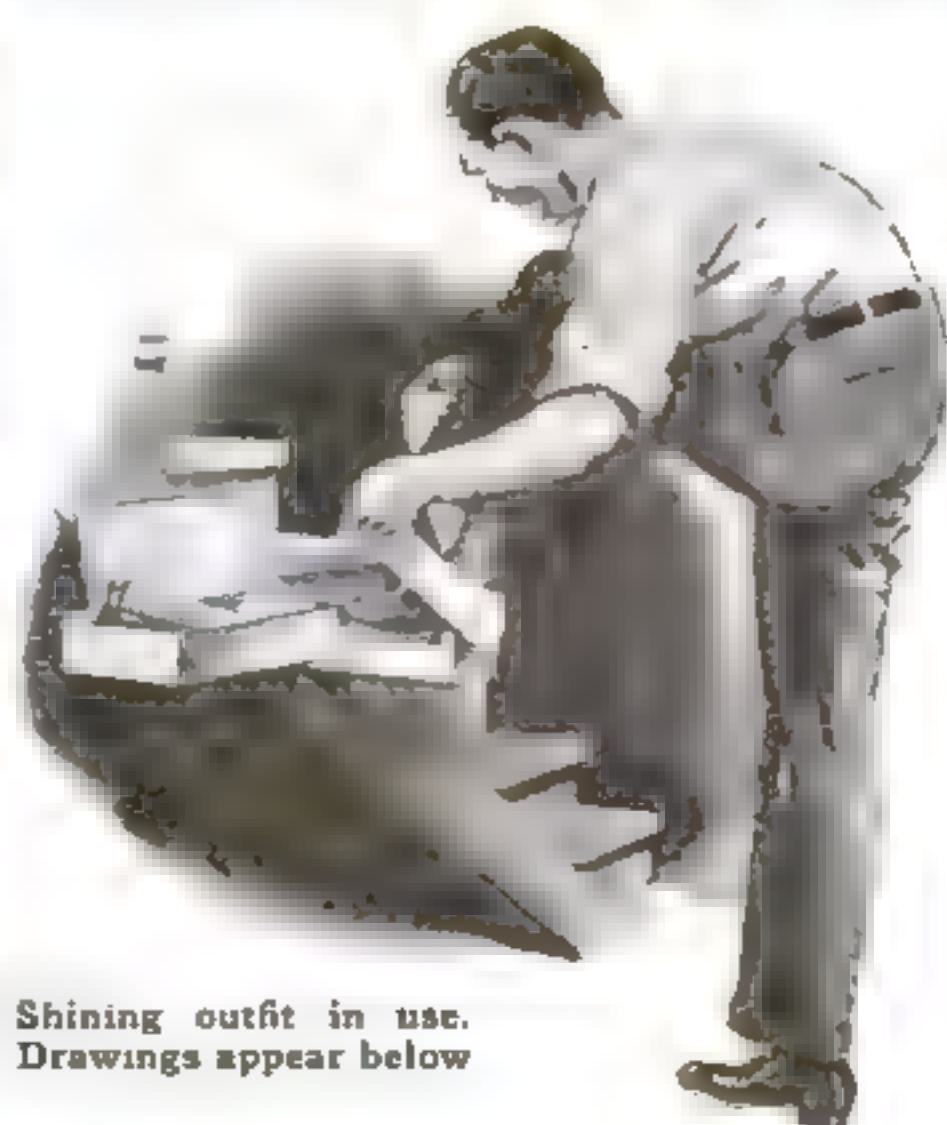
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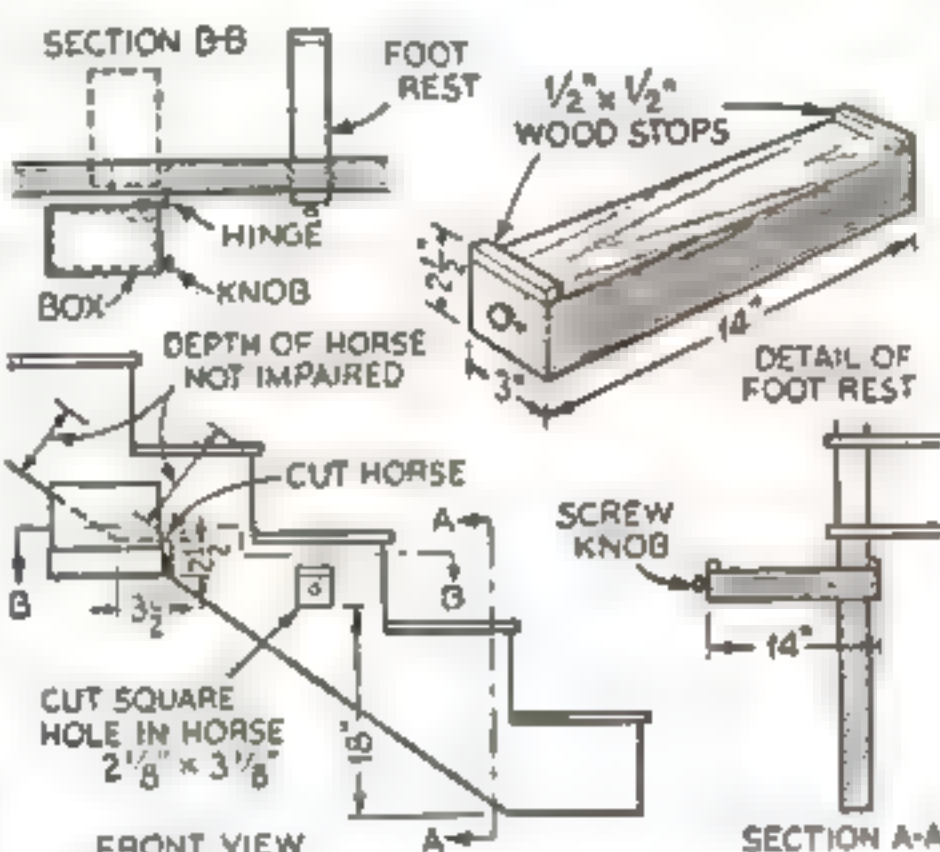
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Shining outfit in use. Drawings appear below

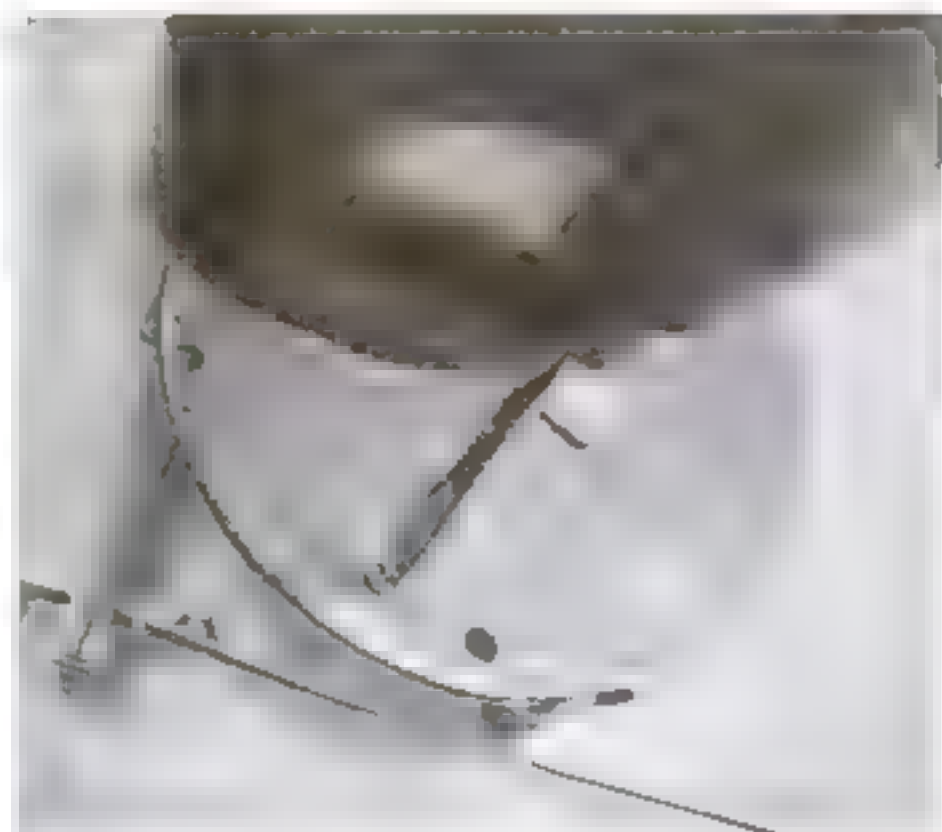
CELLAR STAIRS SUPPORT SHOE-SHINING OUTFIT

CONVENIENTLY installed at the bottom of the cellar stairs in space usually wasted, this shoe-shining stand consists of a strong sliding foot rest and a box to hold polishes, brushes, and cloths. The box is mounted by means of a heavy strap hinge so that it can be swung under the stairs when not in use. The foot rest is pushed in.—L. N. OLSEN.



RECORDING BAROMETER

(Continued from page 75)



The barometer is adjusted to give a correct reading by turning a screw on the underside

of sheets on a gelatin or other type of duplicator. Wind chart around cylinder and hold with two rubber bands. Use register ink or mix equal parts of writing ink and glycerin. Cover. Make of 1/2-in. wood with glass front, and hinge to baseboard.

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HOME EXPERIMENTS SHOW PROPERTIES OF OXYGEN

(Continued from page 63)

feet away. It suggests the scent of garlic, or of much-diluted chlorine gas.

The electric discharge, in this case, rearranged molecules of the oxygen in the air to form ozone. The heat of a flame similarly produces traces of ozone. Ozone is formed around your Bunsen burner as you can prove by a simple chemical test.

MAKE a paste of ordinary cornstarch with a small amount of warm water, in which you have dissolved a crystal of potassium iodide. White paper dampened with this thin paste will turn blue or brownish-black when it comes in contact with ozone; the ozone decomposing the potassium iodide, to form iodine, which in turn reacts with the starch to produce the familiar telltale discoloration.

Place a strip of paper moistened with the starch-iodide paste in an evaporating dish or beaker. Hold the dish near the blue flame of your Bunsen burner, and blow the flame repeatedly toward the paper with a rubber bulb, stopping between each succession of puffs to let the dish cool. Soon the paper will become discolored, thus showing that the hot vapors directed against it contain ozone gas.

For experiments with ozone, the best way to produce the gas is to pass a "silent discharge" of electricity through oxygen—or through the air, which contains about twenty percent of oxygen. A spark coil of the vibrator type, now almost obsolete, but obtainable at low cost in a junk yard, will serve nicely as the source of high-tension electricity when it is connected to three series-connected dry cells or a storage battery. If you prefer, you may use a neon-sign transformer, which can be obtained from makers of these signs for about five dollars and can be connected to any household outlet supplying 110-volt alternating current.

A simple set-up for making ozone consists of a glass tube, ten to twelve inches long and up to half an inch in diameter, sheathed inside and out with metal foil of the kind that comes on chocolate bars or camera films. The inner piece of foil does not have to line the tube snugly. Attach rubber tubing and a rubber bulb at one end of the tube, to force air through it. Connect one of the sections of metal foil to one of the two high-voltage terminals of the spark coil or transformer and the other to the second terminal and turn on the current.

NOW, when you blow air through the tube by pressing the rubber bulb, ozone issues from the other end. You will notice the peculiar odor within a few seconds after turning on the electricity. A piece of the starch-iodide test paper also will show the presence of the gas.

Hold a test tube or a small flask containing a clean drop of mercury near the end of your ozone generator, or "ozonizer," and swirl the mercury about while you blow ozone over it by squeezing the rubber bulb. Soon the drop becomes sluggish and leaves a trail of dross behind it. This is an oxide of mercury. Ordinary oxygen does not attack mercury, but ozone readily oxidizes the liquid metal.

Ozone also will tarnish silver, as you can demonstrate by directing the gas upon a bright silver coin. The experiment works best when the metal is warm, but not hot. Peroxide of silver is formed.

Rubber tubing should not be used anywhere on the delivery side of your ozone-producing apparatus, since rubber is attacked by ozone and the ozone itself is destroyed in the process. Other substances also will destroy ozone, turning it (Continued on page 126)

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SCHICK SHAVES

HOME EXPERIMENTS SHOW PROPERTIES OF OXYGEN

(Continued from page 125)

back into ordinary oxygen gas. One of these is turpentine, as you can show.

Connect your ozonizer with a side-neck test tube or a flask containing turpentine by means of a glass L tube and a pair of corks. The L tube should dip into the turpentine, so that ozone will bubble through the liquid. The side neck of the test tube (or a second L tube, if a flask is used) leads the escaping gas to a horizontal section of glass tubing containing a strip of starch-iodide paper and a bright globule of mercury. Making the mercury stay put is a problem that is easily solved by blowing a small bulb into the side of the glass tubing. To do this, simply hold the side of the tubing in a Bunsen flame until it is red-hot, and then blow into one end, the other end being corked temporarily.

WHEN this apparatus is set working, the ozone bubbles through the turpentine and is decomposed. The starch-iodide paper remains free from discoloration, and the mercury is unaffected, because it is oxygen and not ozone that reaches the exit tube.

A slightly more elaborate apparatus for making ozone can be built around a glass condenser of the ordinary water-cooled type used in making laboratory distillations. Cork the exit end of the inner tube of the condenser and fill this tube with salt water or any other solution, such as copper sulphate, that conducts electricity. Connect a wire dipping into the liquid with one of the terminals of your spark coil or transformer, and the solution itself becomes one of the electrodes of your ozonizer. The remaining electrode consists of a strip of metal foil wrapped around the outer jacket of the condenser, and is connected to the other side of the high-voltage supply.

Pass dry air—or better, oxygen—through one of the side arms and into part of the condenser that ordinarily serves as a water jacket. When the current is turned on, ozone will issue from the other side arm. You can obtain a steady flow of air with a siphon pump improvised from two gallon jugs set at different levels. As water siphons from the upper jug to the lower one, the rising water level in the bottom jug ejects the air, which is led through rubber tubing to the condenser. A pinch clamp in the siphon tube will enable you to regulate the stream of air to any desired velocity.

FIND WEATHER RECORDER LOST SINCE 1913

CARRIED into the upper air twenty-four years ago, an automatic weather-recording instrument disappeared completely until recently, when it was found, half buried in sand, in California. It was one of twenty-three meteorographs, attached to sounding balloons, which were sent up from the Pacific coast in 1913 by the U. S. Weather Bureau, to record conditions in the higher levels of the atmosphere. Fifteen of them, dropping to earth after the balloons had burst, were recovered, and the recent discovery makes the number sixteen. The other seven instruments have never been found. Except for a few dents, the all-metal instrument was still in good condition after a quarter of a century, and many of its recordings could still be deciphered. The temperature record shows that the balloon carried the weather instrument to a height of over thirteen miles, and that a temperature as low as seventy-one degrees below zero was encountered. Many recording instruments, in greatly improved form have been sent up since 1913, and have gathered data of great value in forecasting weather conditions.

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